TEXTILE RESEARCH

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Francis P. Gavan

TEXTILE RESEARCH

EDITORIALS

Interdependent Research

IN HIS brief introductory remarks at the annual meeting President Garvan presented a sufficient number of vitally important subjects for research, most of them economic and social, to keep all of the country's research bodies busily at work for several years. He particularly emphasized research designed to improve the welfare of consumers, to loosen credit to the general public, and designed to answer the question "what price foreign trade?" Most timely were these suggestions in view of the efforts of the Institute's Committee on Economic Research to develop a definite program. The President's suggestions are basic in any program designed to develop methods by which textile production and consumption may be balanced.

The textile industry needs new economic knowledge of distribution quite as badly as does any other domestic industry, and there can be no resultful research in distribution that does not take full cognizance of the condition and welfare of consumers, and of the relative value of foreign and domestic markets; but there must also be due recognition of the fact that the textile industry has benefited to a far less degree from scientific research than have most other industries, and that it should, therefore, be able to profit from it to a greater degree in the future.

Modern industries that have profited most from scientific research and that are recognized leaders in efficient distribution, are increasing their research efforts to provide new products, and to improve and cheapen existing products, in order to take up the slack between production and consumption. Here is practical recognition of the interdependence of scientific and eco-

nomic research. Recognition of this interdependence by the textile industry, and utilization of similar methods, must eventually produce the most satisfactory results, for in both fields of textile research virgin soil is being worked.

Surprising Results

SURPRISE at the large amount of scientific textile research completed or in progress, as shown by our new book, "Textile Research: A Survey of Progress," has been expressed by many who have read that valuable addition to textile literature. They will receive another surprise when they read of the additional scientific and economic research in progress as reported by speakers at our annual meeting, Nov. 3d.

This surprise will not be occasioned by any illusions as to the enormous additional ground to be covered, but rather by the fact that a few organizations and laboratories should have been able to make such a commendable start with so little financial support and encouragement. As compared with what Great Britain, Germany, or even Japan, are doing in fundamental research the showing is poor. It is a feeble showing when compared with what individual units of the most modern of our industries in this country have done and are doing. But it is a start, and it is unthinkable that the great domestic textile industry, sorely needing some previously unemployed factor to balance production and consumption, should fail to give a fair trial to a tool that has proved its effectiveness and worth in other great industries.

U. S. Institute can, as yet, claim no actual scientific research accomplishment. It must await more adequate financing before it can hope to be of greater aid to its cooperating and other laboratories, than through its present promotional, coordinating and informational services. That it has been able to do so much in so short a time in an industry that showed so little prior evidence of research-mindedness has also occasioned surprise in some quarters.

The Annual Meeting

THE THIRD annual meeting of the Institute, held at the Barbizon-Plaza Hotel, New York City, Thursday, Nov. 3d, was preceded and followed by meetings of the Board of Directors, and started with luncheon, between whose courses the business agenda was presented, the luncheon being followed by an interesting speaking program. President Garvan presided and in a brief but forceful address admonished the membership not to overlook research into the welfare of consumers, the conflict between foreign and domestic trade, and that between foreign and domestic investments as affecting credit to domestic industry and consumers.

The attendance of some 50 members and guests was gratifying in view of the impending Presidential election, but this competition once in four years is unavoidable as the by-laws specifically provide for the holding of the annual meeting on the first Thursday in November. For the benefit of those who were unable to be present the addresses and reports are published completely in this issue.

The guest speakers were Mr. Franklin W. Hobbs, chairman of The Textile Foundation and president of the National Association of Wool Manufacturers, and Dr. E. B. Millard, assistant director of the division of industrial cooperation and professor of theoretical chemistry at Massachusetts Institute of Technology.

Directors Elected

A committee on nomination of directors and officers was appointed at the morning meeting of Directors, and its report on directors nominated to fill vacancies was accepted by the Corporation, the members of this committee being the following: Philip A. Johnson, chairman, Dr. E. H. Killheffer and Secretary Clark. The Directors elected were as follows: For three years (re-elected):

James T. Broadbent, Pres., Standard Textile Products Co., New York, N. Y.; Alban Eavenson, Pres., Eavenson & Levering Co., Camden, N. J.; Hon. Francis P. Garvan, Pres., The Chemical Foundation, Inc., New York, N. Y.; P. H. Hanes, Pres., P. H. Hanes Knitting Co., Winston-Salem, N. C.; Ernest N. Hood, Treas., Pequot Mills, Salem, Mass.; Weston Howland, Pres., Warwick Mills, West Warwick, R. I.; W. Scott Libbey, Treas., W. S. Libbey Co., Lewiston, Maine; Prof. Louis A. Olney, Lowell Textile Institute, Lowell, Mass.

For two years: Joseph Bancroft, Chm., Joseph Bancroft & Sons Co., Wilmington, Del.

For one year: H. Grandage, Vice-Pres., Clark Thread Co., New York, N. Y.

Officers and Executive Committee

The nominating committee reported to the meeting of Directors following the meeting of the Corporation the following ticket for officers and members of the Executive Committee, which was accepted unanimously:

President, Hon. Francis P. Garvan; Vice-President, succeeding Albert F. Bemis, resigned, Dr. E. H. Killheffer; Treasurer, Ernest N. Hood; Secretary, Charles H. Clark.

Executive Committee: Alban Eavenson and Ernest N. Hood, re-elected for term of three years; Joseph Bancroft, elected for term of one year, succeeding Thomas T. Clark, resigned.

With these changes the Vice-Presidents and Executive Committee are as follows:

Vice-Presidents: Thomas T. Clark, W. Robert Blum, H. V. R. Scheel, K. P. Lewis and Dr. E. H. Killheffer.

Executive Committee: Alban Eavenson, Ernest N. Hood, Dr. E. H. Killheffer, H. V. R. Scheel, Jos. Bancroft, P. A. Johnson and the President ex-officio.

Corporation Meeting Agenda

The agenda acted upon at the annual meeting of the Corporation was as follows:

1.—Minutes of Last Meeting.

2.—Annual Report of Directors, Treasurer and Auditor.

3.—Secretary's Annual Report.
4.—Report of Research Committee.
5.—Appointment of Nominating Committee.
6.—Report of Nominating Committee.
7.—Election of Directors.

Addresses and Papers

The speaking program following the luncheon and the Corporation's business meeting was opened by President Garvan, who, after introducing the next speaker, Chairman Hobbs of The Textile Foundation, as "the Prince of the textile industry," asked Secretary Clark to preside. Unfortunately, the length of the program left little time for discussion, there being only one speaker, Philip A. Johnson, following the symposium on "Scientific Research in Progress and Planned," and the chairman being obliged to ask those desiring to comment on the "Program of Economic Research for the Textile Industry" to forward their statements to him or to the acting-chairman of the Committee on Economic Research. The meeting adjourned at 3:30 P.M., after a rising vote of thanks to guest and member speakers had been adopted unanimously. The speaking program was as follows:

Opening Address—Hon. Francis P. Garvan.
Address—What Scientific Research Can Do for the Textile Industry—Dr. E. B. Millard.
Symposium—Textile Research In Progress Or Planned.
The Textile Foundation—Mr. Franklin W. Hobbs, Chairman.
The American Association of Textile Chemists & Colorists—Prof. Louis A. Olney, Chairman, Research Committee.
U. S. Institute for Textile Research, Inc.—Dr. W. E. Emley, Chairman, Research Committee.
Bureau of Standards—Dr. W. E. Emley, Chief, Organic and Fibrous Materials Division.
Discussion.
Symposium—A Program Of Economic Research For The Textile Industry. Introduced by Paul T. Cherington.

Report of Committee on Economic Research—Fessenden S. Blanchard, Acting-Chairman.

The Wool Industry—Paul T. Cherington.

Address—Notes On The Colloidal Aspects Of Textile Chemistry As Presented At The Recent Meeting Of The Faraday Society—Dr. Harold DeWitt Smith.

Members Present

In addition to the guest speakers, Mr. Franklin W. Hobbs and Dr. E. B. Millard, and other guests the following members, or accredited representatives of members, were present: Fredk. L. Babcock, John Bancroft, Jr., William W. Buffum, Paul T. Cherington, Charles H. Clark, Daniel E. Douty, Alban Eavenson, Dr. W. E. Emley, Ephraim Freedman, Hon. Francis P. Garvan, Thayer P. Gates, Herbert Grandage, Joseph F. X. Harold, Ernest N. Hood, A. P. Howes, Horace Jaquith, Philip A. Johnson, Dr. E. H. Killheffer, Harry Levine, Mrs. Pauline B. Mack, Mr. McGibbon, E. W. McGowan, Robert Moore, Prof. Louis A. Olney, Dr. J. Petschow, Lawrence Richmond, Mr. Sargent, David C. Scott, Charles L. Simon, Harold DeWitt Smith, A. M. Tenney, Werner Von Bergen, Douglas G. Woolf.

New Memberships

Only one new member was elected at the Nov. 3d meeting, Mr. Alex. Morrison, Chemist, American Woolen Co., Andover, Mass., who has been the representative of the life membership of the American Association of Textile Chemists and Colorists, becoming an annual member, but since the annual meeting a gratifying number of applications have been received that will be acted upon at the next meeting of the Executive Committee.

The President's Address

By Hon. FRANCIS P. GARVAN

FELLOW-MEMBERS of the Institute: I am not going to tire you with a speech. You are here today to discuss the question of scientific research and its situation in reference to the textile industry; but I just want to ask you one thing and that is to also consider research into the welfare of your consumer. That, to my mind, is just as much a scientific necessity today as your other scientific inquiry. The question of whether he is able to buy, whether he is able to get credit, whether he has employment and the other questions which face us today I believe should become a part of your investigations and should be set forth in articles in your magazine.

We face today a great conflict between two theories: the theory of self-containment and, on the other side, is the big broad field of our becoming great in international trade. That, I think, is a subject for scientific investigation by you manufacturers.

The question of credit is to my mind the most important one in the solution of our present panic. There is no credit in this country today for the ultimate consumer. The international foreign bankers in control of the great banks of New York and through those great banks in control of the 20,000 banks throughout the country are shivering with fear from the effects of their having become the siphons by which our earnings and our savings have been squirted abroad; and they sit today hoarding the credit resources of the country against the day when they may be called upon to call their foreign loans losses, and the result has been each day an increased denial of credit to the consumer of your products.

All these questions are questions which come down to an answer to the question of what price foreign trade? Foreign trade is a good thing. No one can gainsay that. In 1929 we exported eight or ten per cent of our production. That was a

good thing, but nobody has ever researched into what price we paid for that export.

The same with prohibition. It is only recently—the last two or three weeks—that two scientific books have been published as the result of scientific research into the question what price prohibition? We have got to become a nation of people asking not only whether a thing is good or bad but at what price we attain it. We have got a nation now of 120,000,000 consumers. They are very rapidly, since the cessation of immigration, becoming a homogeneous people. The German-American or the Irish-American or the Italian-American is a thing of the past.

In addition to that we are rapidly becoming a nation of educated people. When I attended high school in 1890, I was one of ten per cent of the boys and girls of America who were given the advantage of a high school education. Today over 60 per cent of our boys and girls have that education. When I went to Yale College, I was one of less than one per cent of the boys and girls in America that were given that advantage. Today over ten per cent of our people are college educated.

That means an entirely different consuming body, a body that will not be satisfied with specious arguments but will require that when you come to them you come to them with theories based upon scientific research. I think that all of us are too ready to adopt slogans prepared for us by the parasites of our business and the parasites of our banking and the parasites of our educational life.

I don't want to say any more because my head is full of campaign talk, but I think that after this campaign we ought to set aside politics for awhile and begin to discuss the actual conditions which have brought us into this panic and the way by which we are to work ourselves out. (Applause.)

What Research Can Do for the Textile Industry

By Dr. E. B. MILLARD

IT IS A PLEASURE to me to atttend the meeting of an association in which a former President of the Institute of Technology was so keenly interested. This has been shown not only by his enthusiasm for this textile research organization, but by the active prosecution of various lines of textile research in the Technology laboratories in Cambridge. That work has not been dropped on account of Dr. Stratton's passing; it is being carried on much as he wished it.

Trade Secret Losing Caste

A glance through your report of progress, which has just been printed, shows that textile manufacturing is already well along in its transition from an art to a science. While the textile art is as old as civilization, textile science has not yet reached maturity. To be sure, its infant clothes were laid aside some time ago; it has experienced its growing pains, the perils of voting, of shaving, of going hungry, and other unpleasant but not fatal concomitants of early manhood; but it is not yet fully grown.

One of the strongest indications of its advance has been the fall in caste of the "trade secret," which upon examination is quite as likely to be a cause for blushing at our ignorance as it is to be a matter of value. By cherishing it too fondly we may conceal from ourselves the fact that our "secret" method has long since been replaced by a better one in every mill but our own.

To a large degree this change in attitude has come about as the result of research; of persistently inquiring why? or how? or how fast? or "how come"? Such questions and their obvious extensions require asking again and again for each of our

varied processes; in order to be sure that we have really answered them, and that we have not merely re-stated our perplexity in longer words. When we can answer these questions about textiles with any degree of satisfaction, the scientific control of textile processing will have been accomplished. And let us hope that art will not then have deserted textiles, but will have learned to abide in peace with science to their mutual benefit, as has so notably been achieved in architecture.

Textile Research Backwardness

But your annual report also shows that there is still very much to be done. In my opinion it indicates that American chemists and engineers have not taken a major part in this work for the last decade or two, nor indeed have they done their fair share. The references to important work at the end of each chapter are chiefly to British and German periodicals; and what is a matter for still less pride, the articles in our American textile magazines are occasionally pretty closely related to research appearing a convenient number of weeks before in a foreign journal.

The underlying cause of this inferiority of American achievement is not a lack of evidence that industrial support of scientific research pays in other industries. Some of the most conspicuous support to pure science research has been given in the field of Petroleum, by Tide Water, Shell, the Standard Oils of N. Y., New Jersey, Indiana, Louisiana and others. Noteworthy achievements in the Electrical field have come from the splendid laboratories of General Electric Co., Western Electric, Westinghouse and Bell Telephone. The very highest quality of chemical research has been done in the duPont, Eastman Kodak, and Union Carbide laboratories, and in those of the large rubber companies. Some of these latter laboratories have done creditable textile research of their own. The General Electric Company, by publication of its reseraches, has stimulated an army of scientists outside of its organization into doing research of great benefit to the electrical industry. In a few cases they have detailed highly specialized problems to college laboratories for study where qualified experts are available in these places. The work is financed upon a cooperative basis and published as soon as completed.

A much longer list of companies fostering research could readily be compiled if this were not sufficient proof of the value of scientific research to industry. I am not speaking of plant studies or economic surveys, which are obviously of immediate benefit, but of the highest type of fundamental research in pure or applied science. The industrial contributions rival those of the best college laboratories in this field.

Our lack of productiveness in research is thus not due to inferior capacity, or initiative, or originality on the part of American scientists as compared with those residing abroad, and it most certainly is not because the textile industry has had no need of research. Nor is it due to a lack of volume of business against which to assess the costs of research, for the gross volume of the textile industry largely exceeds the combined total of all of the advocates of research to which I have just referred, yet our total expenditure on fundamental science would scarcely last the smallest of them a week.

Textile products enter in one wise or another into every other business under the sun. One cannot build a house or eat a meal or drop a nickel into a telephone without involving a thousand of its wares. Those champion illustrations of inevitability, death and taxes (already known to the textile industry), yet involve its fabrics, for we may neither die nor be taxed except by the use of materials supplied by it. Thus we are assured, even in times such as these, that the use of our materials cannot utterly cease.

Causes of Research Backwardness

One of the contributory causes for this inferiority in research has been a lack of coordination among the unbelievable number of small units, with no close connection to a central clearing house for information and ideas. In many cases we may have been afraid to exchange information from a just suspicion that the material received in the exchange would not be of great value, and in the rarest instance perhaps we have been aware that we had nothing very startling to offer on our side of the trade. But given the desire for such a fair exchange, where does the textile man turn to arrange it?

A second factor is the predominating volume of our home markets, with far less dependence upon foreign outlets than is

the case abroad. On this account we may have been less eager than our neighbors across the water to devise new processes. But with the volume of our output much below capacity and greatly in excess of consumption, the development of improvements in many lines would seem to be a pressing need. No man will feel hampered in meeting this situation by a better knowledge of his raw materials or of their reactions to processing.

A third excuse may be a pardonable desire of each mill to meet competition by safeguarding what little advantage it may have over its neighbors, though this may well be held at too great a cost.

And, finally there is the failure on the part of this industry to appreciate that in science all things do not come to those who wait, but await those who come. A thorough understanding of this simple fact should have stimulated our research activities years ago; its emphasis may not be amiss in promoting greater diligence, now that we have begun.

Adequate Financing Needed

The remedy for this condition with respect to textile research lies along the paths already indicated by your report of progress, but at considerable distances down those paths. One of the chief requisites would seem to be much larger appropriations toward the support of research by the whole industry. We often cherish the fruits of our own labors more than we do the free gifts of the gods. A very small contribution on a percentage basis by all of the textile manufacturers would provide a huge sum for scientific research. While many will be frightened at the prospect of any further levies or taxes against the industry for any purpose, could money be used for a better purpose than providing life blood?

Obsolete machinery of however great beauty, or the newest machinery for making a fabric nobody wants, are unpleasant to our thoughts; but if by research we do not keep ahead of the times, we shall have both. The New England specialist in horse blankets of twenty years ago probably did not begin research on motor robes when the Selden automobile patents were first issued, but when there was no longer any market for horse blankets.

British Textile Research

While comparisons of our achievements with those of others are usually unpleasant, it may not be idle to point out that the British textile industry and the British government have subsidized with large sums of money a vastly broader program of fundamental research in England than has been attempted here. Just outside of Leeds a beautiful old country estate has been converted into a research laboratory for the study of wool and the problems of the wool industry. Under the guidance of Dr. S. G. Barker some sixty workers have been engaged there upon this study for many years. Complete chemical, biological, microscopic, optical and physical laboratories; and small-scale plant equipment are available; and instrument shops are maintained for building new apparatus as soon as required. Certain aspects of special problems are also detailed to University laboratories, notably Oxford, Cambridge and Leeds. The problems under investigation relate to the properties of wool as a raw material, its chemical behavior, its elasticity, extensibility, fineness, strength and durability. They study the manufacturing processes from the scouring of grease wool to the final brushing, as well as the influence of each process as a unit operation on the characteristics of the final product.

Many of its labors would be classed as pure science research. Now the layman has been carefully taught that the words "pure science research," when applied in describing any project whatever, virtually forbid him to criticise it or even to wish to understand it. But Dr. Barker is no layman; he knows that much which is called pure science research is neither pure nor science nor research; and he excludes such trash as firmly as he supports a truly scientific project. No small part of the driving enthusiasm of this laboratory arises in his office, but every worker in the place (and there are no drones you may be sure) supplies enthusiasm of his own in abundant measure. If 4 P.M. is sacred to tea, the tea is served in the laboratories, work is scarcely interrupted; and 5 P.M. is not so sacred to a dash for the 5:11 train if the work of tomorrow can be done better by a few minutes more work today.

In Didsbury, which is just outside of Manchester, a larger number of workers, and a larger estate, are devoted to similar

research for the cotton industry. Other laboratories, which I did not see, are maintained for the silk and linen and rayon manufacturers. In these places, under the guidance and the inspiration of competent leaders, who do not insist upon being called directors, many scientists are carrying on the work at a satisfactory rate. "Trouble shooting" for individual mills is excluded entirely from these laboratories, and only an intensive study of new material for the textile industries is carried on. We have nothing approaching it in this country and the ratio of their expenditures on science to ours would bear the relation of a good salary to carfare.

A Potential Roentgen Needed

Another requirement for our progress is probably patience mixed liberally with our perseverance, for the problems of the textile industry are complex, and the field is large. We may explore vast areas quickly by flying rapidly over at great heights for general information, but in so doing we certainly miss the fair faces and the golden opportunities readily to be found by a closer survey at leisure. Once an enthusiasm for research is born, its greatest peril is in wishing to accomplish too much too soon, and we must guard against this quite as much as against doing too little hurriedly.

Only persons of great vision and the broadest possible education should be allowed to select the problems to be studied. One of moderate capacity might reject important clues or even great discoveries on account of his inability to sense their significance, and he might urge the study of trivialities or his hobbies at great length. If Roentgen had set out to give direct help to the medical profession with the greatest invention of all time, it is exceedingly improbable that he would have been working with the materials which led to his discovery of X-rays. Moreover, if there had been a person of less perspicacity than Roentgen doing the work, his first observation of the effects of X-rays might have brought out a new profane word to indicate that his photographic plate supply had been spoiled, and there the matter might have ended.

The experiment upon which he was working had been performed many times before by many people, with something like

the same chance of seeing all that Roentgen observed. Indeed, unquestionable records show that X-rays had been produced by experimental means one hundred and ten years before they were discovered, and that in the interval their effects had escaped observation, times without number.

Who knows whether some discovery of as great importance now lies in plain sight in our work, waiting for a man whose eyes can see it? Suppose you yourself had found Roentgen in your textile laboratory, with some wires and glass tubes, fussing around an induction coil in a room darkened at mid-day. Would you have allowed him to continue until he discovered X-rays; or, feeling sure that forty years might elapse before they could prove their usefulness in textiles, would you have ordered him back to his twist counter? The problem of course is to know who is a potential Roentgen and who is not. But if the electrical engineers can find and assist Steinmetz, or Whitney, or Langmuir; and the medical research institutes can cherish Noguchi and Carrell, need we despair at the prospect of finding one such genius for our own work, and of doing as much for him? What would we not give to have him now developed, ready to guide and inspire the research workers engaged on our problems?

The vast spread of the textile industry over the continent, with a mill in almost every village, makes coordination of effort to the very highest degree the vital need, the essential link without which we fail. For, without coordination, millions of dollars, or millions of men, or even millions of years may be squandered in spinning thin uneven threads or twits of fact; some of value, many of none at all. With coordination, researches become the yarns to weave a wonderful fabric whose pattern is clear to all. Perhaps none of us will last long enough to see it completed, and of course the whole design will not be evident as soon as weaving has started, but with the beams dressed and in the looms, and the harnesses rising and falling, we may know we are on our way. We shall certainly have down ends and broken picks from time to time; we may even have to suspend weaving altogether while we spin a little filling yarn a time or two; but we shall not have to alter the main design, and we most certainly shall not have to sell the product at a loss to promote business.

The Colloidal Aspects of Textile Materials

By Dr. H. DeWITT SMITH

THE FARADAY SOCIETY is one of the younger and one of the most active of English scientific societies. It was organized in 1903 by a group whose primary field was electro chemistry, but whose interests soon led the society into related branches of physical chemistry, so that today it has come to be associated with that whole borderland of science between the old classical fields of chemistry on the one hand and physics on the other.

An outstanding feature of the society's policy is the organization from time to time of a general discussion on some subject of special interest. Several years ago a committee on colloids was organized and the society arranged to devote one meeting every second year to a general discussion of some aspect of the study of colloids.

At these colloidal meetings a special effort is made to bring together an international group comprising as many as possible of the outstanding workers in the field under discussion, for the two-fold purpose of providing in the sum of all the papers presented, an adequate summary of the contemporary state of knowledge of the subject, and at the same time of furthering a discussion and interchange of views and theories through personal contact between the various workers, thus measurably stimulating and hastening the advance of knowledge of the subject.

The Program

It is the second of these colloidal discussions on the subject "The Colloidal Aspects of Textile Materials and Related Topics," which I have been requested to describe to you briefly today, because I had the honor of accepting an invitation to attend this meeting as one of the foreign guests.

An idea of the international nature of the gathering may be visualized by observing that the 29 papers on the program were contributed by 13 authors from England, six from Germany, two each from France and from Holland, one each from Switzerland and the United States. The American contributor was Dr. S. E. Sheppard of the Kodak Research Laboratories, who was unfortunately unable to attend in person.

The program was divided into three parts, as follows:

I. Raw materials and their constitution. These were handled under 3 subdivisions: (*a*) cellulose, (*b*) cellulose derivatives, (*c*) protein fibres.

II. Fibre particles, their production, deformation and degradation.

III. Manufacturing processes.

For our purpose today the papers can best be grouped by raw materials, namely, cellulose and its derivatives, wool and silk.

Cellulose and Its Derivatives

Many of the ideas presented were not new. Some of the papers, for instance, were in the nature of a summing up and reinforcement of ideas which had been launched before. The presentation at this meeting served not only as a defense on the part of the worker of his particular contribution but also as a target for the criticism and discussion of his colleagues.

The cellulose molecule came in for its share of punishment, as Prof. H. Marks, formerly of the I. G. Farbenindustrie, pointed out in a witty speech at the president's banquet to the foreign guests. In an effort to wrest from it the last secrets of its structure and behavior it had been shaken by Prof. R. O. Herzog, of Berlin; swollen by Prof. Katz, of Amsterdam, and by Mr. S. M. Neale, of Manchester; hydrolyzed by Prof. Haworth, of Birmingham; stretched by Prof. Mark; X-rayed by Dr. Trillat and Dr. Mathieu, both of Paris; spread on water by Dr. Adam, of London; nitrated by Dr. Miles, of Ardeer; saturated with moisture by Dr. Sheppard, of Rochester, N. Y.; dissolved by Prof. Standinger, of Freiburg, and shot through and through with polarized light by Mr. Preston, of Manchester, all to provide those present with something to talk about.

And they did talk: Hardly a paper went unchallenged in some respect and out of the cross fire of criticism and comment and the evidence of the papers themselves, emerged a clearer picture of the present day knowledge of the structure of cellulose and its physical and chemical behavior. The point worthy of emphasis here is that research today brings a great variety of tools and methods to a single problem and integrates the separate results into a picture of the whole.

The chain of glucose residues is quite generally accepted as the fundamental unit. Haworth and Hirst offered chemical evidence that the chains are straight and not looped into an endless ring form. Adam's measurements of the spreading of films of cellulose derivatives on water indicate that they can be spread to layers of monomolecular thickness with the chains lying flat on the water and that the chains are flexible rather than rigid. Herzog showed that solutions of cellulose derivatives as dilute as 1/64 per cent possess structures which can be broken down by shaking.

Mark offered some interesting calculations of the mechanical properties as deduced from micellar orientation and Preston gave calculations of the extensibilities of rayons based on measurements of their refractive indices. These I believe are the first attempts to interpret the mechanical properties quantitatively from X-ray and optical observations.

The micellae themselves came in for a searching bit of criticism by Neale whose study of the modifications of cotton by swelling and by degradation leads him to doubt the necessity of the micellar concept in explaining his and other results. He argues that a continuous structure of chain molecules suffices. However, the "rhythmic variation of crystalline structure without sharp discontinuities," which he admits is necessary to explain the nature of the X-ray diagrams, seems to me to be very far removed from the micellar concept. The point is that the micellar concept is a useful one but the present trend of knowledge indicates that the structure of solid cellulose is probably continuous, rather than discontinuous, with inhomogeneity of structure rather than discrete particles.

The various experiments with spreading, hydrolysis swelling, etc., apparently indicate, however, that, whether the micellae be clear cut entities, or whether they be parts of a continuous but

unhomogeneous structure, the ultimate particle in solution is a long single thread or chain of glucose rings. Sheppard's paper supports the view that a breakdown to single chains occurs upon solution and that the micellar structure of rayons and fibres is due to "recrystallization" rather than to the presence of the original micellae or chain bundles.

Despite the increasing evidence that there is no such thing as a definite uniform cellulose molecule, the problem of obtaining the "molecular weight" or chain length was pursued from various angles. The results vary widely (from 100–200 glucose units by Haworth's chemical method to about 600 glucose units according to Staudinger's viscosity method).

Turning from pure research to some of the more immediate problems of textile technology Prof. Roehrich, of Paris, contributed a method of studying the degree of ripening of cotton based on measurements of the diameter after mercerization and of the weight per centimeter.

Prof. Krais, of Dresden, discussed the behavior of mercerized cotton yarn in dyeing, stressing particularly the effect of drying on the absorption of dyestuffs, the effect of traces of mineral acids and the influence of light and air on the sensitivity to dyes.

Protein Fibres

While this discussion on cellulosic fibres occupied a full day and a half of the conference the protein fibres held the stage on the last day.

The X-ray was turned on animal hairs and other protein fibres by W. T. Astbury, of Leeds University, a crystallographer of the new school whose work in recent years on textile fibres has contributed a great deal to the knowledge of protein structure. Swelling, or hydration of protein fibres, was examined by Dorothy Jordon Lloyd, of the British Leather Manufacturer's Research Association in London, and by Dr. J. B. Speakman, of Leeds University.

The present view of the protein fibres is that of a polypeptid chain (chain of amino-acid residues) the backbone of which is similar for the various types of hair, wool, horn, etc. The nature of the side chains determines the type of protein and stronger cross linkages exist between the CO and NH groups of the poly-

peptid chains than in the case of the cellulose chains. Swelling in water is due to the polar attraction of water molecules at the OH, NH and other groups and is influenced as in the case of cellulose by the nature and degree of cross linkage between chains and by orientation. Fibrous proteins, in which the chains are better oriented or packed together, are the most resistant to solvents.

New Knowledge of Wool

In wool the amino-acid residues are so oriented as to produce a folded chain. Wool can be stretched to as much as 70% of its length in water with complete elastic recovery. The silk chain is an extended chain and under suitable conditions can be made to fold or contract to almost half its original length.

The need of a more complete analysis of wool into its constituent amino-acids was mentioned in order to clarify the nature of the cross linkages.

A study of thin protein films, and the electrical resistance of single wool fibres, were brought to bear on the problem of wool structure. This latter paper, by Dr. M. C. Marsh, of the Wool Industry Research Association at Leeds, offers a new method of measuring specific electrical resistance of various single fibres which should certainly be of value to the electrical industry in addition to giving interesting data on the effects of various treatments on the electrical properties. Here is a new tool with which to attack problems of structure and of behavior in processing.

From the biochemical side a study of the function of sulphur in wool and hair growth was offered by Dr. A. T. King, of Leeds. Dr. S. G. Barker, Director of the Wool Industries Research Association, discussed the physical significance of crimp or waviness in wool. He points out that crimp is a function of time not of hair length. Sheep grow four crimps per month whether the hair grows slowly or rapidly.

The Papers on Silk

Three papers from the British Silk Research Association, by Dr. Denham, the Director, and Dr. Lonsdale, covered the lateral and longitudinal swelling of silk, the regain of various silks at various humidities and the tensile and elastic properties of silk.

This last paper contains a great deal of interesting data on strengths, structures, true elasticity and elastic after-effect or flow of silks under varying humidities.

For instance, previous work on the flow or elastic after-effect which all textile fibres exhibit has indicated that increasing humidity causes an increased rate of flow and a decrease in true elasticity.

This paper shows, however, that, whereas increasing humidity does cut down the true elasticity and retard the rate of recovery from a given stretch, complete saturation with water restores the elasticity and rate of recovery to that of the bone dry fibre.

Their studies of the swelling of silk and of isoelectric points are of interest in connection with the recent work of Harris at our Bureau of Standards.

Dyeing Also Discussed

Dyeing was discussed in two papers. Professor Ostwald, of Leipzig, pointed out small concentrations of neutral salts, such as sodium sulphate, *raise* the solubility of substantive dyes whereas further increase of concentrations causes the well known salting out effect.

For instance, five times as much Benzo purpurine 4B can be dissolved in a 0.01% sodium sulphate solution as in pure water.

Professor Elöd, of Karlsruhe, discussed the theory of dyeing of acid dyes on animal fibre and strongly supports the chemical theory of salt formation between the color and the protein base.

Impressions

The features of the meeting which impressed me the most were, first, the liveliness of the discussion which followed practically every paper; then, the variety of research tools and methods which are being brought to bear on textile problems; and, finally, the stimulation to one's thoughts and ideas on practical every-day problems of textile manufacture and processing which come from the facts which research workers are unearthing, often in fields which seem unrelated to our own immediate interests.

Scientific Research

Symposium on Textile Work in Progress and Planned

THE SYMPOSIUM on Scientific Research in Progress and Planned, which was one of the features of the annual meeting, was introduced by Mr. Franklin W. Hobbs, in his capacity as chairman of The Textile Foundation. Prof. Louis A. Olney, chairman of the Research Committee of the American Association of Textile Chemists and Colorists, reported for that organization, and Dr. W. E. Emley, chief, Organic and Fibrous Materials Division of the Bureau of Standards, Washington, D. C., reported for the Textile Section of that body, and also for the U. S. Institute as the chairman of its Research Committee.

Fast Dyes for Acetate Yarns

The only discussion was a suggestion by Mr. Philip A. Johnson, president and treasurer of the Aspinook Co., Jewett City, Conn., and a director of U. S. Institute, which follows: "Mr. Chairman, there is a matter that came to my attention recently; that is the great lack of adequate knowledge as to the dyestuffs which are applicable to acetate yarns. I know from experience that there have been considerable claims presented on account of the fact that acetate fabrics dyed in dark colors (such as Navy blue and brown) have shown a tendency to change in the dyed fabric, or after having been cut up and sewn into a garment. This changing apparently is not due to exposure to light as it occurs frequently when the goods are thoroughly protected from the light. It seems to be analogous to the problem of dyestuffs which are not fast to storing. Because of the fact that these fabrics could be used to a considerable extent if they were made fool-proof in that respect, it seems as if it might be a practical problem that would be worthy of consideration."

Work of the Textile Foundation

By FRANKLIN W. HOBBS, Chairman

IT IS a great pleasure to be your guest today as Chairman of The Textile Foundation. Your Secretary, Mr. Clark, has asked me to tell you something of the work of the Foundation. We have already published a study of "The Commercial Problems of the Woolen and Worsted Industries," made by Paul T. Cherington. A similar work by Professor Copeland of the Harvard Business School on the Cotton Industry is almost ready for the printer. We have also authorized another study to be done for the silk industry and hope to have it started soon.

You, however, will be more particularly interested in the research fellowships and scholarships we have awarded in the fields of chemistry, physics, biology and engineering, planned to bring about scientific knowledge and advancement in the textile industries and their allied branches.

The Program's Broad Purpose

The broad purpose for this far-reaching program is to build up and develop a body of research-trained men who, although engaged in scientific fields, will at the same time be working and thinking in terms of textile fibre and textile development. In all branches of industry there is a growing appreciation of the close relationship between research and the ever-changing problems of production. As an indication of the country-wide interest in our plan, I may state that there were nearly seven hundred applicants from thirty-nine states. It is also of interest to tell you that those to whom awards were made are now carrying on their work at the University of Illinois, Massachusetts Institute of Technology, Lehigh, University of North Carolina, Alabama Polytechnic Institute, Clemson Agricultural College, Princeton, Cornell, Harvard, Georgia Tech, Dickinson College, Lowell Textile Institute, North Carolina State College, Manchester University and University of London of England.

The men are all at work, but fundamental research of the sort that is being carried on requires a good deal of preparation and study of existing knowledge of the problems in hand. There-

fore we cannot expect, and have not as yet received, reports of a type that might be suitable for report and discussion at this time, although I can assure you good progress is being made. The fellows are all at work and personal interviews by Mr. Pickard with them and their directors reveal a high level of qualification and interest which promises much for the future of the general plan itself and corresponding benefits to the industry. A few comments, however, at this time may be of interest:

At Princeton, under Dr. Taylor, the problem is, "Protective Effects in Textile Deterioration and Dye Fastness," and the habits of the oxygen atom are under consideration.

At Cornell the subject is "The Application of Polarized Light to Textile Research."

In Manchester, England, the work is on "The Orientation of the Constituents of the Benzene Ring," a subject that is somewhat of a mystery even to the scientists, but we believe that results, when achieved, will be of fundamental and far-reaching importance to the textile industry.

At the University of North Carolina the disposal and recovery of textile waste is being looked into and textile men will readily understand the value of that work.

There are three men at work in the Massachusetts Institute of Technology. One is working on the "Microbiology of Textile Fibres" and at present is entirely on cotton fibres; another is on "Micro-Analysis of Fibres," which embraces the structure of fibres; the third is on "Spectrophotometric Analysis of Dyed Materials," for measurement and analysis of color in textile materials.

At Harvard the research is on "Elastic and Plastic Properties of Textile Fibres," and apparatus has been developed for obtaining the relationship between stretch and strength of individual fibres under any desired conditions.

This will give you a general idea of some of the work that is under way, but, as I have said, it is too soon to really make any definite report. I am sure definite results of this research work will come later and be of great practical value to the textile industry.

Research Defined and Evaluated

A few days ago I read in *Mechanical Engineering* a statement by Arthur Koehler, in charge of the Forest Products Laboratory, United States Department of Agriculture, at Madison, Wis., and in closing I quote from him the following:

"Research is a systematic exploration of the unknown. Such recent and familiar products as cellophane, bakelite, rayon, irradiated foods and sound pictures are not the result of a hit-or-miss search, but are the fruit of systematic exploration performed in research laboratories. . . . Does research pay for itself? One need only consider the widespread use of many inventions based on research to answer the question. An enumeration of the industries that have grown in the last twenty-five years also recalls those which have been backed by research. The increase in the number of research laboratories in the chemical, metallurgical, textile, and other industries also attests that research pays.

"Right here it is well to point out the difference between invention and research. An invention is the application of known facts and principles in a new way. For example, the steam engine, self-binder, sewing machine, and even the automobile to a large extent were inventions based on known mechanical principles. Research, on the other hand, is the search for new facts and principles which may subsequently be used in inventions. The discovery of bacteria brought to light a hitherto unknown fact on which the use of antiseptics is based and which makes possible aseptic surgery and the preparation of serums that have saved millions of lives; the development of anti-knock gasoline is the result of the discovery of the real cause of 'knocking' in internal-combustion engines; the strength of rayon yarn was tripled by the discovery that the molecules could be 'oriented' parallel to each other and to the length of the yarn, as revealed by x-ray diffraction patterns, by applying tension to the yarn while coagulating; and the radio tube was the result of the discovery that heated metal emits electrons which carry with them various electric charges.

"New inventions are possible without research, and the Patent Office attests that they are made daily, but, by and large, invention must wait on research. Without the discovery of new

facts and principles for inventors to use, invention would gradually decline. Frequently one scientific discovery can be used in numerous diverse inventions. For example, the electromagnet is used in telegraph and telephone instruments, armatures of dynamos and motors, electric bells and buzzers, magnetic hoists, arc lights, automatic controls, and the like. Research, however, is not concerned with physics and chemistry only. It may be purely mathematical, such as determining by statistical analysis the relationships of wage-scale and length of working day to production, or the relationship of distance traveled by salesmen and costs by automobile and train. Working out such relationships brings to light new facts and principles, hitherto unknown.

"We need more faith in research. It need not be a blind faith either, for the past has given us abundant evidence of what research may bring forth."

Mr. Koehler has so well stated the value of research that I felt it worth reading to you. While I realize there is no need to urge upon you the need of research, nevertheless there is need for a continued and increasing use of, and belief in, research and we may all take hope and inspiration from such a splendid statement.

Research Committee of A. A. T. C. & C.

By Prof. LOUIS A. OLNEY, Chairman, Research Committee

A FEW DAYS AGO Mr. Clark asked me to present a brief report on the work of the Research Committee of the American Association of Textile Chemists and Colorists at this meeting. At first thought it would seem out of place for one association to be presenting a report at the annual meeting of another, but I think a few words of explanation will show that after all this situation may be perfectly logical.

About three years ago the officers of the textile chemists association were seriously considering an organized drive to secure funds to maintain a laboratory for research work and for textile testing. At this same time the United States Institute for Textile Research was in a formative state, and it appeared to the officers of our association that it would be a great mistake for two differ-

ent organizations to go out and at the same time attempt to collect funds from the textile industry for somewhat similar and, perhaps overlapping, work.

Serious consideration of both projects led many of us to believe that, since the American Association of Textile Chemists and Colorists was far more specialized in its work and the U. S. Institute for Textile Research far more general, our efforts should be exerted toward helping the U. S. I. T. R. raise its funds and then later on when, and if, the latter was able to do so they might assist us by appropriating funds toward the support of our work. To show their good faith the A. A. T. C. C. took out a $1000.00 life membership, and contributed $100.00 toward the work of forming the Institute. You will therefore see that the two associations are bound together by an affiliation which while not official is certainly far more than a mutual interest.

The Association and Its Work

The American Association of Textile Chemists and Colorists is sometimes referred to as the Association with the long and impossible name. It seems quite strange that so many twists have been obtained in those few words. I think the most humorous came to me last week when I received a letter addressed to the Chairman of the Research Committee of the "American Association of Textile Chemists and Florists." (Laughter.) For simplicity we commonly refer to it as the A. A. T. C. C., and some have adopted a mathematical formula and refer to it as the (A square T C square) $A^2T\ C^2$.

As I look about the room, I not only see many who are members of our Association, but at least three who are chairmen of sub-committees of our Research Committee. To them I need say nothing about our work, but I believe that to the others an outline of what the A. A. T. C. C. is doing through its Research Committee will be of interest.

About eleven years ago it was organized and, from a group of about twenty men who had enough enthusiasm and vision to see the possibilities of such an association and to go ahead with its formation, it has grown to an organization of over 1300 members with eight active local sections, two in New England, one

each in New York, Philadelphia and Chicago, and three in the South.

I will read one of the objects of the Association as set forth in the constitution which will show you right away the reason for our Research Committee. There are four of these objects; but I will read only one, namely: "To encourage in any practicable ways research work on chemical processes and materials of importance to the textile industry."

With this in mind our Research Committee has from the very beginning been one of the most important standing committees, if not the most important of the Association. We have at the present time 42 members of this committee, geographically distributed throughout the country, and representing the very best technical and scientific minds in our branch of the technical and dyestuff industries. We meet on an average of once a month, and the remarkable interest shown will, I think, be borne out by the fact that usually we have no less than 20 members present at these committee meetings. In addition there are, of course, innumerable meetings of the various sub-committees. Much of the work has been divided and assigned to such sub-committees of the Research Committee and at the present time we have 18 of these sub-committees actively functioning.

Some of the Sub-Committees

In order to show you the wide scope of our work I am going to read the names of some of these sub-committees: Fastness Tests for Dyed Silk; Fastness Tests for Dyed Wool; Fastness Tests for Dyed Cotton; Light Fastness; Fastness to Perspiration; Research Program (A very important committee as it plans to a considerable extent many of our research problems); Bibliography of Textile Chemistry, Bleaching, Dyeing and Finishing; Testing of Water-proof Textiles; Fabrics for Rubberizing; Color Standardization; Standard Methods of Determining Sizing, Weighting and Finishing Materials in Textiles; Construction of Dyeing and Finishing Machinery; Wetting Out Materials; Chemical Analysis and Testing as applied to the Textile Industry; Rayon, and Analysis and Standardization of Sulphonated Oils.

I think you will see from this list of sub-committees the wide range of work which we are covering at the present time. We have three full-time research associates, two located at the Bureau of Standards in Washington, and the other at the Lowell Textile Institute. Two of these have been made possible through the instrumentality of The Textile Foundation.

Research Subjects

I am going to outline a few of the subjects that we have been working upon during the past year, and I will then take one of these projects and go into it with a little more detail in order that you may see the way that one subject in particular has been worked out very successfully.

We have been actively working upon the following subjects during the past year: Light Fastness; Shrinkage of Textiles; Ageing Tests for Water-proof Fabrics; Comparison of the A. A. T. C. C. Methods with German Standard Methods; Comparison of the New "FadeOmeter" with the "Fugitometer"; Standard Methods for Analysis of Sulphonated Oils, and Preparation of Dye Standards.

I wish to speak about the preparation of these dyed standards. In each case where we adopt a standard method for dye fastness, we select certain dyestuffs as being typical of the different grades of fastness that are classified. Eventually we expect to put out dyed samples which indicate each of the different grades described in our standard methods of fastness. This has already been done with dyed silk. These four samples (holding them up for the audience to see) represent the four different grades and anyone carrying out our tests can secure from the Association this set and thus be able to check his work and make sure that he is getting correct results. We are at the present time working on standard samples of dyed wool in the same way, also of cotton.

In connection with the comparison of the A. A. T. C. C. methods with the German methods, I might say that we have advocated from the very beginning international cooperation and a set of international standards. We are in communcation with the British research workers and also those of Germany, and,

while it will be a long and slow process, the ideal that we have in mind eventually is a set of standard methods for determining and recording dye fastness which will be uniform in the United States, in England, in Germany and in all other countries that may wish to cooperate.

Work of Research Associates

The following projects have either been completed or are now being carried out by the two Research Associates who are working under the Textile Foundation allocations: Determination of the Iso-Electric Point of Wool; Determination of the Iso-Electric Point of Silk; Study of the Relationship Between the Quantity of Dye Absorbed by Wool and the Electrical Charge of the Wool; The Chemical Action of Sunlight on Silk Fibre; Standard Methods of Determining the Fastness of Dyed Wool to Fulling, and A Study of the Chemical Mechanism of the Wool Carbonization Process and of the Specific Cause of Irregularities Which Occur During That Process.

There are several other subjects which are under consideration at the present time and I might add that we have a meeting of our Research Program Committee tomorrow morning, to consider this further, consequently I would not care to say much about these particular subjects until they have been passed upon by the committee. There are at least four, however, which we consider very important and they are being planned for next year.

There are other research problems which are being worked upon by our Research Associates at the present time but they are not completed, and much of this work will extend over into another year.

There have been published, or are about to be published, the following papers:

The Iso-Electric Point of Wool, by Dr. Milton Harris; The Iso-Electric Point of Silk, by Dr. Milton Harris; Report on the Standard Method of Determining Fastness of Fulling, by Mr. B. A. Ryberg; Report on Ageing Tests for Water-proof Fabrics, by Mr. Wm. C. Smith, and Report on Methods of Determining Moisture in Sulphonated Oils, by Mr. Ralph Hart.

Fastness of Dyed Wool to Fulling

There is one piece of work in particular, the one to which I have already referred, which has been carried through this year and has been made possible entirely through The Textile Foundation; that, I will take just two or three minutes to go into with more detail, because I think it illustrates very well the practical results of what might be called typical textile research work.

When the Association was formed, one of the important types of fastness under consideration was the fastness of dyed wool to fulling, and a laboratory method was devised which, while satisfactory up to a certain point, was decidedly unsatisfactory because it did not check up with practical results obtained in the textile plant and with which it was difficult to obtain uniform results. It was contended at that time that the only possible way to carry on a satisfactory fulling test was right in the fulling mill, and after working on the other method for some time with no great improvement the work was discontinued.

About two years ago it was thought that after all this particular problem might not have been attacked in the proper way and we went at it again. During the past two years at least a thousand tests have been made and different dyeings studied, with the result that today we have a test for fulling which is recognized by five of the largest woolen and worsted mills and three of the largest dyestuff corporations as being the equivalent of, if not better than, the fulling test that is carried out in a fulling mill.

The amount of work involved in the solution of this research problem will not be shown by any brief description, but the test is carried out in a piece of apparatus we call the "Launder-Ometer," which is the standard washing machine of the Association. We experimented for at least six months on different kinds of jars. Originally we used glass jars, and later porcelain and various types of metal containers, in an endeavor to get something that would withstand the action of the steel balls which have to be used in the jar along with the sample that is being tested. The steel balls (holding them up for inspection) are regular ¾ in. ball bearings made of stainless steel. You can readily see that these steel balls, banging around loosely in a

revolving jar of almost any kind, would soon result disastrously. We next tried placing one larger steel ball between two pads of the dyed wool that was being tested, but before the tests had proceeded very long (they have to be run 4½ hours) the steel ball had worked its way through the pad. To cut a rather long story short I will say that at last the idea was conceived of making a piece of tubing (knit tubing) out of worsted yarn, cutting it into strips about 3½ inches in length (illustrating), dyeing it with the dye to be tested, putting four of these steel balls right into the sack thus made from this worsted tubing, and then running it in the glass jars of the "LaunderOmeter." We can run these tests four hours and a half, and as far as we know if they have been properly done, we have never broken a glass jar. You get as perfect a test as might be desired.

I have here three samples to illustrate just the results that we would get. Inside of this sack along with the steel balls there is sewed, or fastened, a piece of worsted cloth containing cotton, two rayons and a silk thread, and these tests are run for half an hour, 1½ hours and 4½ hours, with the result that at the end of 4½ hours we have a complete felting of this material. (Exhibiting samples thus run.)

This sample represents the highest standard of fulling. It has been run for 4½ hours in an alkaline soap solution, with the constant banging of the four steel balls, and it will be noted that the dye has not stained any one of those four threads in the worsted cloth. You will see also that it is very decidedly felted, but has not lost any color and that it represents the highest type of fastness to fulling.

Here is the poorest of our standards (illustrating). This is the third type. You see the color has run badly in the wool and it has stained the other. In the intermediate standard, as you can see, the fibre has been stained some, but not very badly.

Now those tests have been thoroughly checked up. Dyed samples were sent to five different mills and three dyestuff concerns. They ran the tests through according to our specifications and they all reported practically uniform results for the same degree of tests. As a result we have accomplished what was at first considered impracticable. This is the type of work that we

are doing and this particular project has been made possible through the Textile Foundation.*

A Central Research Laboratory

I was glad that Prof. Millard made the statement about the highly developed textile research laboratories in Great Britain, and the funds appropriated toward their support. At the time the U. S. Institute for Textile Research was formed, we had it in mind that it might develop into the one central organization that would raise funds, and act as a clearing house, and sponsor for systematically organized research for the whole textile industry. At that time I had, and still have in my mind, the ideal picture of a suitable building, centrally located, and devoted entirely to textile and allied research, with one wing of that building, if you please, occupied entirely by the American Association of Textile Chemists and Colorists as the headquarters of their research activities, and another wing housing the most complete reference library of textile books and journals in the world.

After all, this is not so much of an impossibility, or improbability, as one might think, and to prove this, all you need is a pencil and paper and the application of simple arithmetic. Census figures, I believe, show that there is something like 4 to 5 billion dollars worth of textile materials of one kind or another marketed in this country during a year. One-tenth of a cent out of every dollar of sales would furnish between four and five million dollars annually for such work and certainly would be no drag on any one. Even if you take $\frac{1}{5}$ of this amount, namely, two cents on every one hundred dollars worth of textile materials sold you would still have approximately one million dollars a year for textile research.

If the U. S. Institute for Textile Research can educate the textile industry to contribute this insignificant amount regularly and systematically, toward the support of research work, all of which is primarily for their good, textile research and the future of the industry would be assured in this country. At the present time the textile industry is contributing towards research consid-

* The complete report of this work will be published in the Proceedings of the Association in the November 21st edition of the *American Dyestuff Reporter*.

erably less than one cent on every thousand dollars of sales. Think of that!

Financing of A. A. T. C. C. Research

It might be of some interest to know how the research work of the A. A. T. C. C. is supported. Our dues are very low, $5.00 a year. This amount is more than absorbed in overhead and general expense even though up to the present time we have had no paid officers whatever. We therefore have to depend entirely upon returns from our Corporation Memberships and outside support for the promotion of our research program. Incidentally, the National Association of Wool Manufacturers has helped us generously on three different occasions, and more recently the Textile Foundation has supported some of our projects. The one already described was made possible wholly through an allocation from the Textile Foundation. We hope that the results of our work during the past year will justify the continued support of these agencies.

Work of Bureau of Standards

By Dr. W. E. EMLEY

IN GOING OVER the list of textile research problems under way at the Bureau of Standards in the U. S. Department of Commerce at the present time I find it is quite a long list and obviously I cannot go into detail about each item. In fact, several of them have already been covered sufficiently by Professor Olney. I shall select, therefore, one or two to show you the type of work and something about the way in which this research work is conducted.

Development of Cotton Parachutes

To start with, let's take the question of the development of cotton parachutes. Five years ago the Army and Navy became somewhat alarmed at the fact that our parachutes were all make of silk, and they came to the Bureau of Standards to find out if some substitute for that silk could be discovered. The National Advisory Committee for Aeronautics took the matter under their jurisdiction and gave some money to the Bureau of Standards for the research work.

Our first step was to consult with the officials of the Army and Navy to ascertain the properties that they desired in a parachute fabric, and we found that they were quite well satisfied with the fabric that was already on the market except for the fact that it was silk, but beyond that they didn't

seem to have very much definite information. They knew its weight and they knew its strength. They said it should have a certain amount of air permeability because if the air goes through too rapidly the parachute will come down too fast. If the air doesn't go through rapidly enough, the parachute will wobble. So there must be a maximum and a minimum on air permeability.

Also they felt that it should have a certain degree of resilience, so that when the parachute was pulled out of the bag it would spring open as a silk fabric does and not lay limp as a cotton fabric does. So the first thing we had to do was to devote two years on the development of test methods and the building of machines to measure air permeability and resilience. Having completed that job we then got samples of the silk fabrics which were in use and tested them in order that limits could be set on these properties.

We then were able to write a specification including the four desirable properties: strength, weight, resilience and air permeability. Then we were ready to start on the main job, trying to find out how to make such a fabric of cotton. That required a great deal of designing of fabrics, putting them in the mill, making up sufficient fabric to make a parachute, having the Navy make the parachute and take it up to Lakewood to drop it to see how fast it fell, and finding out what was wrong with it and then redesigning it and building it over again.

Meanwhile the cotton industry had developed a cotton parachute, so that we were getting help from the outside as well as carrying the work on from the inside. Finally, a parachute was developed which is satisfactory for the purpose. Then of course we started right in to see if we couldn't improve that parachute.

We found the limitation of cotton as a material for the purpose, and this past year we have studied the mercerizing process and have found that we can make certain changes in the mercerizing process which will greatly increase the strength of the cotton and thereby make it more nearly approach the strength of silk. That was a big step in advance.

Then this same body (the National Advisory Committee for Aeronautics) came to us again to see if the things we had found out in studying parachute cloth could not also be applied to the outer cover for dirigibles; and there we were able to make use of our previous experience and go one step further by designing cloth of a slightly different weave, which increased the tearing strength of the cotton fabric something like twenty fold over what it was in the old balloon cloth.

This year we have another allotment of funds from that same National Advisory Committee for Aeronautics to see if we can find some way to fireproof this outer covering for dirigibles.

I cite that as an illustration of a research problem which was initiated by the consumer, which involved going back to fundamentals to develop academic facts; involved testing research in that we had to build our own testing equipment; and, finally, getting into mill research because we had to make our own fabrics; and the fact that the industry came in at the right time and helped us out so that the latest figures I have indicate that 65 per cent of the parachutes now in use are made of cotton.

An Unexpected Result

There is another problem that is quite different. It had its origin in the Federal Specification for manila rope. It seems that the Federal Specification includes a requirement that manila rope shall be made of certain grades of manila fibre. The manila fibre is all graded in the Philippines. When we get a sample at the Bureau of Standards of the finished rope and we are asked to ascertain whether or not that rope meets the specifications, it is impossible to do so. You can't tear a finished rope apart and find out whether or not the prescribed grades of fibre were used in making that rope. It has a lot of oil and dirt and one thing or another in it, and the fibres are all mixed up together, so it is flatly impossible to do it.

It was ascertained that the grading in the Philippines is done very largely on the basis of color. That seems to be the main criterion; the theory being that the lighter colored fibre will give the most durable rope and, therefore, that is the highest grade fibre, and those grades are definitely limited in the Federal Specification for manila rope.

So we have been spending the past nine months setting up machinery and designing equipment to measure the color of manila rope. That has been carried to a great extent at the expense of the Cordage Institute. We have finally succeeded in doing that and now we are engaged in measuring the color of manila rope and hope that some day we will be able to find something definite to put into the specification instead of this item covering the grades of fibre.

It is an open question whether the color of rope has any relation to the value of the rope. We may spend a long while trying to find out how to measure the color of manila rope and then find the results are no good after we get them.

Measuring Durability of Carpets

We have been doing a lot of work on measuring the durability of carpets, and we believe that now we have a laboratory test machine which can be used to measure the durability of a carpet and the results of which can be checked up against practical service, at least in so far as the experience of the manufacturers of various grades of carpets will enable us to do so.

We have now, in cooperation with the Navy, an extended service test so that we can get a final answer on this accelerated laboratory test. Meanwhile, we are using the accelerated laboratory test to investigate the factors which enter into the manufacture of carpet, the grade of the wool, the length of the pile, the density of the pile, whether an underlay is good for a carpet or not.

Incidentally, in order to measure the value of this accelerated laboratory test, we had to find some way to measure the thickness of carpet, and those of you who are members of the A. S. T. M. will recognize what troubles we had in that particular job.

Recapitulating, the parachute investigation was done at the instigation of the consumer; the rope investigation at the instigation of the manufacturer; the carpet investigation was started by the consumer, although the manufacturer has taken it over and is cooperating more than the consumer now.

Why Textile Fibres Contain Water

Then once in a while we are able to do a job of our own and there we try to get into the highly academic work. Perhaps the most interesting item there at present is the question of water content of fibrous materials. Some two years ago there was a paper published by some physical chemists at McGill University on the water content of wood, which was extremely interesting in that it did not just simply stop with finding out how much water wood contains under given conditions, which is what the textile industry seems to have done mostly, but it went further and tried to find out why there was any water there at all.

We have been able within the past two months to duplicate the equipment that was used at McGill, and now we are ready to go ahead with this fundamental investigation as to why wool, or rayon, or cotton contain any water at all.

As I say, we have any number of items here, but the point that I want to emphasize is that the research work done at the Bureau of Standards originates from one of three sources: It comes either from the consumer (by "consumer" I mean some other government department), or it comes from the industry, or sometimes we are able to originate some of this work ourselves.

Work of U. S. Institute

By Dr. W. E. EMLEY, Chairman, Research Committee

IN THE two books, "Survey of Textile Research in the United States, 1931," and "Textile Research: A Survey of Progress," and in the list of Textile Foundation fellowships, you will find complete information about the research in progress and planned. Rather than taking your time to look backward at information which has already been printed, I would ask you to look forward with me towards the goal of textile research, noting a few of the obstacles that must be overcome.

Authoritative Nomenclature Needed

The first obstacle noted by anyone with scientific training is the lack of a definite system of nomenclature. Botanists, zoologists, geologists would find their records of accomplishment completely unintelligible if they were deprived of their systems of nomenclature, which have been empirically created but generally accepted. Chemists are trained to look for the fine distinction between sulphides, sulphites, and sulphates. Scientists naturally look askance at an industry which admittedly cannot tell the difference between a printcloth and a sheeting, between a yarn and a thread. An industry built on a yarn numbering system such that in one factory a high number means a fine yarn and in another factory it means a coarse yarn must seem hopelessly antiquated to the scientific mind, and hardly worth while coming to an understanding thereof.

A yarn numbering system based on the "TYPP," thousand yards per pound, was suggested in the *Textile World* for April, 1931. This has been officially adopted by the Federal Standard Stock Catalog Board. An ex-

haustive dissertation on textile nomenclature, including a proposed system, has been prepared by Mr. Appel for consideration by the Interdepartmental Committee on New Uses for Cotton. It is hoped that textile manufacturers will take these movements seriously.

"A Good Foundation"

The ultimate aim of all research is to find a better or a cheaper way to perform a given service. Fundamental research may be considered as being the foundation, applied research the superstructure. Of course we can and do build many superstructures without foundations, but they are apt to give way at the first breath of adversity. A good foundation, on the other hand, may be used to support many different kinds of superstructures, many of which were never dreamed of by the original designer.

Inter-industrial Competition

So many people seem to have the idea that the aim of research is to find a better or cheaper way to make a given thing. This idea is fundamentally wrong, but is nearly enough true to be dangerous. Having spent much time and money in trying to improve the quality of his product, and having met with apparent success, a manufacturer is still in danger of finding that some entirely different kind of product will monopolize his market, for the very good reason that it gives more satisfactory service. The textile manufacturer must realize that his product will be called upon to compete not only with similar products made by his fellow textile manufacturers, but with all products, by whomsoever made, which can be used for the same purpose.

We often hear of research to improve the quality of the product. The word "improve" should be studied carefully. We are too prone to accept the ballyhoo of some salesman in deciding that this product is better than that, or to base the decision on equally unreliable but respected obsolete experience. The only safe criterion is "Which product gives the best service?" I therefore strongly urge all members of the textile industry to stop thinking of things and start thinking of services, and to guide your research work along this line.

"It has often been said that the price of progress is research. That is correct, but I will go further and say that the price of safety and even of existence in the modern business world is research."—C. J. Ramsburg.

Economic Research

Symposium on Program of Economic Research for the Textile Industry

IN THE ABSENCE of Chairman H. V. R. Scheel of U. S. Institute's Committee on Economic Research, and of vice-chairman Fessenden S. Blanchard, the symposium was introduced by Mr. Paul T. Cherington of that committee, and his report for the woolen and worsted industry, and that of Mr. Blanchard for the Committee on Economic Research, were filed for publication. The lateness of the hour prevented discussion.

Introduction

By PAUL T. CHERINGTON

THE COMMITTEE on Economic Research realizes that it has a field to cover which is perhaps a little alien to that which interests most of you, but we start with the thought that the textile industries as they are operated in this country, at the present time at least, not only are of the nature of an art and of a science, but that primarily they are of the nature of a business, and that no matter how carefully developed a process or a product may be, if the consuming public decides that they will not buy it, its production will very promptly cease.

That group of problems associated with the textile industries as a business has taken on much greater importance during the last few years than ever before. There are a number of reasons for this, but perhaps two are sufficient for mention at this time. The first is that as a result of a group of very complicated and difficult economic conditions, styles and fashions have become democratized. Instead of those people who have an economic justification for trying to be fashionable being the ones who are fashionable, everybody feels that he has an inborn right to be reasonably fashionable.

Effect of Style Democratization

The bearing of that on textile production has been revolutionary. Products which formerly could be made by the exercise of art or of science now have to be made primarily by the exercise of those aspects of the industry which have to do with business. They have to be produced so that they can be sold for more than it costs to produce them, and con-

sequently all of the other research problems which the industry has to do with find themselves modified and determined to a considerable extent by these economic influences which have to do with whether the goods can be sold or not.

The fact that styles and fashions have become democratized has given to technical fabrics somewhat the nature of a newspaper. We don't care, as consumers, what kind of ink, what kind of pulp, what kind of printing presses are used in the production of the newspaper. What we want is the news. Does the paper give us the news in the form that we like to have it? If it does, we will buy it. If it doesn't, it can be printed on fine old rag paper with ink that costs $30, or $40 a ton and on presses that cost half a million dollars, but it doesn't interest in the least.

Consequently, these business aspects, these economic aspects of textile production have been greatly exaggerated and increased in importance by this phenomena, to which for brevity I have referred to as the democratization of styles and fashions.

Penalty of Excess Productive Capacity

The other great economic change which has come within the last few years in the textile industry grows out of the over-equipment of the industry. The economic consequences of that also are revolutionary. There was a time when a textile manufacturer could determine for himself what he would make, and he could be reasonably sure that if he could hire the right kind of a sales organization he could sell it, but when there is more product made than will be sold, there at once appear in the marketing end of the business two important groups: One is the group that is going to be left behind. If more is to be made than will be sold, somebody's goods will be unsold. A great many more will be sold at no profit for fear of being left unsold, so that those two features of the meeting of the business aspects of textile production have become enormously important and, in a word, the sceptre of control over the consumption of textile products has passed from the producer to the hands of the consumer.

Consumer the Ruler

We as consumers of textile products are the ones who decide whose goods will be left behind, and by virtue of that we decide also those who will be unable to sell their products at a profit for fear of being left behind. Consequently it has become increasingly incumbent on the textile manufacturer not only to have due regard for the consumer in planning his operations, but throughout the operations to keep himself sensitive to the changes; not only the changes that are going on in the consumers' minds currently, but, what is more important still, to those changes which are likely to take place in the consumers' minds at the time the manufacturer's product is going to be put to the test of salability. For these reasons, economic problems have taken on a seriousness and a complexity and an importance in the textile industry during the past few years which they never had a relatively short time ago.

Outline of Committee's Report

Now you will find in the November number of TEXTILE RESEARCH (for which I think the office ought to have the cordial congratulations of

everybody) a summary of the first preliminary report of this Committee on Economic Research. From pages 27 to 31 there is a tentative list of suggestions as to the kind of subjects that are important in the present state of the industry. This is not a final list. It is simply an indication of what the Committee, after a number of long and serious and extremely interesting discussions, developed out of some 100 or 120 different problems that were put before it as being the ones on which the members of the Committee could agree as being definite enough and pressing enough for us to be willing to suggest to the Institute as suitable subjects for economic research.

Those have, as you will find in the pages 32 to 41, been submitted to a number of people for further suggestion and opinion, and I think you will find extremely interesting some of those opinions expressed by people in the textile industry and outside of it (some, economists) as to the relative importance, or the relative significance, or the relative value of these 16 subjects which have been suggested.

Your Committee feels that, in a field as new as this, one of its first tasks is to clearly see its own job; and, secondly, to feel its way along with the help of those who are in the industry, so that there can be developed some idea of things of importance and, at the same time, things which can be made sufficiently definite and specific, so that they can supplement the extremely valuable work that is going on in the art and science aspects of the textile industries, and bring the business aspects of it up to something like a comparable high standard.

Report of Committee

By FESSENDEN S. BLANCHARD, Vice-Chairman

ABOUT ONE YEAR AGO the Directors of the Institute created a Committee on Economic Research under the chairmanship of Mr. Scheel, vice-president of the Institute. I am sorry that Mr. Scheel is abroad, so that he cannot tell you of how our committee got going under his guidance and of the many long arguments we had before we decided just what Economic Research meant and what we should do about it.

In May, 1932, our committee submitted to the Institute a "Preliminary Report on Economic Research," covering the committee's conceptions of its functions and submitting a list of subjects as a tentative program of research. Briefly speaking, the committee considered its field to include in general the economic problems of textile production, distribution and consumption, and its functions to cover the submission of a program of research in this field and the finding of ways and means for carrying out such research.

The first task was to outline a tentative program fairly wide in range and to find out how the industry felt about it. Accordingly a list of 16 subjects was included in the Preliminary Report and it was at the same time suggested that the report be circulated among various men and groups including members of the Institute, representative foundations and research organizations, textile schools, professors of economics, and representative men in different branches of the industry. The report also contained a request for comments on the subjects listed, for additional problems that

seemed important, and for such information as might be available on researches already done or being done on these subjects.

No attempt was made to list the subjects in any particular order of importance, for it was hoped that a better understanding of what the industry felt to be most important would develop from an analysis of the comments received after the report had had a fairly wide circulation. The subjects listed were published in the November number of TEXTILE RESEARCH together with a number of the comments then received from manufacturers, merchants and economists to whom an advance copy had been forwarded.

The Preferred Subjects

It is interesting to see how the comments have come in, based on a tabulation of the first 25 letters which have been received.

"Balancing and Stabilization of Production and Sales" is mentioned as being of first importance by 12 of the 25. One or two think this is more important than all the rest put together.

"Pricing and Price Policies" is mentioned as being especially important by 10; "Cost Methods in Production and Marketing" by 6. "An Inventory of Equipment and Production Potentialities for each Branch of the Textile Industry" is mentioned by 5. Not a single subject of the 16 failed of specific mention by at least one or two of the 25 letters.

The November issue of the Institute's new magazine has given wide circulation to the report, and it is the earnest hope of the committee that many more criticisms and constructive suggestions will be received.

Cooperation Requested

It is the purpose of the committee to await the results of this publicity and the further suggestions that arise from it, before attempting to work out a more rounded program of research, which would have the authority of the industry's needs behind it, as expressed by its representative men. In the meantime, the committee would greatly appreciate the aid of members of the Institute and others interested in textile research in placing the committee in touch with significant research work that has already been done or is being done in the subjects listed.

Other Work in Progress

In the cotton industry, for example, the Harvard Business School, under the direction of Professor Copeland, is working on a study of merchandising organization and methods. This study is being financed by the Textile Foundation, and is being conducted in cooperation with an Advisory Committee on Distribution, representing most of the important associations in the industry. This investigation has covered interviews with over 120 companies in all branches of the trade and representing over a third of all the spindles in the industry.

Mr. Cherington will tell you of the work he has already done concerning the woolen industry for the Textile Foundation.

The Silk Association of America is conducting a survey of productive capacity in the silk and rayon field with the support of its members and of the Textile Foundation.

Among other researches being undertaken on the subjects listed is one on "Selective Distribution" by the Policyholders Service Bureau of the Metropolitan Life Insurance Co. This is being conducted with the aid of a number of trade associations, and it is hoped will be of value to the trade.

It is the purpose of the Committee on Economic Research to aid the Institute in calling to the attention of its members researches in the field of economics and distribution which seem important to the industry. It will also be their purpose to attempt to find ways and means for the conduct of research on the subjects not already satisfactorily covered. This will await the development of the more rounded program which I have already discussed, and which we hope will have the support of the industry behind it, and in particular the support of the members of the Institute, who represent the forward looking men of our trade.

The Wool Industry's Problems

By PAUL T. CHERINGTON

THE MANUFACTURE of textiles, as it is practiced in this county, is not primarily an art or a science, or even a craft. It is essentially a business. Any fabric, made of any fibre (no matter how meritorious or worthy) will cease to be made very promptly when its manufacture no longer is profitable; or, in other words, when the public no longer will pay for it more than the cost of its production.

The commercial elements in textile production have increased enormously in importance during the past few years as a result of two familiar features of textile selling, namely: the democratization of styles and fashions and the over-equipment of the industry.

In the first place, the exaggeration of the style element in textiles has reduced to comparative insignificance many of the factors having to do with the intrinsic properties of fabrics. This has given an entirely new significance to research work in commercial operations compared with research work in technical fields.

This point perhaps can be made clearer by the use of a familiar parallel if we were to discuss the newspaper business from the standpoint of its present importance and future development; technical research operations in pulp, paper and ink production, and the improvement of presses would have their place, and it might be quite an important one. But any discussion of the future of the newspaper business which did not give substantial attention to the development of newsgathering facilities and circulation methods would be recognized at once as a very incomplete consideration. Reluctant as the textile industries have been in their recognition of a need for greater research in technical fields, they have been still more tardy in their recognition of the possibilities of research in commercial lines, and yet the commercial aspects of the textile industry are not less important relatively than are the news-gathering operations of newspapers or their circulation methods.

Little Commercial Literature

The recognized literature of technical research in the textile business forms a very substantial and worthy collection of printed volumes in many fields and current material is to be found in numerous places. Commercial studies, on the other hand, are extremely rare. Until this report was prepared for the Textile Foundation, I know of only one book on the commercial aspects of the woolen and worsted industries published in this country and that now is out of print. In cotton, silks and the other fibres there are a few accepted studies and there are also a few volumes on styles and fashions and kindred subjects; and there is, of course, the useful study of textile distribution made by the Harvard School of Business Administration five years ago. But generally speaking, research contributions in this field have been extremely meagre.

This was the state of affairs which led the Textile Foundation, Inc., to include in its research program some provision for research undertakings in the commercial field. Mr. Blanchard's report has outlined the general character of the work thus far undertaken.

Subjects Covered by Wool Report

Similar to the suggestions of the Committee in some respects, is the list of subjects for more extended inquiry in connection with woolens and worsteds contained in my report to the Textile Foundation. This list is as follows:

1.—Statistical practices of mills and selling houses:
   a. For keeping track of current conditions in the market.
   b. For planning production in the light of current sales.
2.—Styling methods of mills and selling houses, including facilities for observing style trends, for designing, for checking on acceptance and modifications of styles.
3.—Experiences and practices with respect to cancellations.
4.—Mill costing and practices for staples, style fabrics in volume production, and high style fabrics and new designs.
5.—Current practice in devising and standardizing colors.
6.—Methods in use for equalizing production in seasons when there is hesitation in early orders.
7.—A study of price breaks in recent years including a chronological record of the breaks, and an analysis of the causes for the breaks, and by whom they were inaugurated.
8.—A detailed cost study of a limited number of fabrics compared with a corresponding price history.
9.—Opening dates and prices for a selected list of fabrics compared with subsequent sales and price histories for given seasons.
10.—Stock plans and other practices of retail organizations and how they can be utilized in equalizing mill production schedules.
11.—A survey of consumer buying habits with respect to wearing apparel and other wool textiles.

This list is merely by way of suggestion. But the main thought ought not to be obscured by agreement or disagreement with concrete items. The principal aim should be to bring about wider recognition of the need for and the practical value of economic research in the textile industries.

Annual Report of Directors

YOUR Executive Committee has rendered this annual report to the Board of Directors and the latter body has accepted and presents it as its annual report to the Corporation.

Your books of account have been audited and certified correct, your Treasurer's report showing that the Corporation continues to operate in black figures. Among the other accomplishments of our second year the following warrant summarizing:

Accomplishments

The willingness of Hon. Francis P. Garvan to accept the responsibilities of the presidency of U. S. Institute, and to give us, in addition to his valued services, those of Mr. William W. Buffum, treasurer of The Chemical Foundation, Inc., as his active representative in U. S. Institute.

An increase in your membership as of Sept. 28th of 245 to a total of 385, this comparing with 136 at the close of the 1930–31 fiscal year.

The publication of "Textile Research: A Survey of Progress," a volume of 286 pages which reflects great credit upon its contributors, cooperators, and the Committee on Abstracts and Bibliography that had charge of its compilation. It is hoped that it may prove even more effective as a promoter of research-mindness among textile men than as a mere record of textile research progress.

The authorization of the publication in printed form of a monthly magazine, TEXTILE RESEARCH, succeeding the old mimeographed bulletin, and making possible a more adequate service to members and the industry, and a product more in keeping with its subject matter.

The selection by The Textile Foundation, for most of its 20 researches now in progress as fellowships and scholarships, of subjects that were originally selected by our Research Committee as a part of the latter's program, and that were published in the "Survey of Textile Research in the United States, 1931," that we compiled last year for The Textile Foundation.

The preliminary report of the Committee on Economic Research, which has won the praise of many leading manufacturers, merchants and economists, and has as its objective a program of studies of the industry's most pressing and vital economic problems.

These and other scarcely less important accomplishments will be referred to in more detail in this report under their respective headings.

Our President

For the ability to have prevailed upon Hon. Francis P. Garvan to add to his duties as president of The Chemical Foundation, and to his multitudinous other services for the benefit of mankind, the presidency of U. S. Institute, we are indebted to Dr. E. H. Killheffer, director and member of the Executive Committee. He made known his success at the meeting of

the Dircetors Jan. 22, and it is hardly necessary to quote the records of that meeting to prove that election was by a unanimous vote. His induction into office occurred at the meeting of the Corporation in his honor in New York, May 4, which was participated in by most of the presidents of the leading textile associations, leading research authorities and other notable men. We would like to recount here the many services that our President has performed for U. S. Institute in the few months that he has held the office, but, in deference to his emphatically expressed wishes, we are not only prohibited from adopting a formal vote of thanks for them, but have also been warned not to spread upon the minutes of our meetings record of certain of his most valuable services. Bearing these prohibitions in mind the members of U. S. Institute will make no mistake in awarding him credit for all unidentified services.

Memberships

Sept. 30, 1931, U. S. Institute had 2 life, 35 contributing and 99 annual memberships. As of Oct. 1, 1932, and prior to renewals and resignations, U. S. Institute had 2 life, 36 contributing and 347 annual members. Renewals of old memberships to date are slightly less than last year for contributing memberships and for annuals slightly greater. U. S. Institute now numbers in its membership a substantial proportion of the leading manufacturers, merchants and technicians of the industry, and its major immediate membership problem is to ensure the permanency of its present membership and to endeavor to lift as many as possible from the annual to the contributing class, thus making available funds for needed and planned scientific and economic research.

Last year a membership promotion committee was appointed by former president Stratton consisting of Mr. Scheel, chairman, Messrs. Eavenson, Hood, Killheffer and Winchester. After planning a series of luncheon meetings in the principal textile centers, and selecting a local committee for a Philadelphia meeting, it was decided last January to postpone further activities of the committee until business conditions were more propitious.

While the Secretary, with the aid of various members, was able to effect valuable additions to our membership, and an exceptionally large percentage of renewals of old members, the plan by which we were able at the meeting Sept. 28th to elect 245 new annual members was the outstanding membership accomplishment.

Research Work

The Research Committee having completed its organization work during the 1930–31 fiscal year, and having delegated specific activities to subcommittees, held but three meetings of the main body during the year under review and its most important accomplishments are the work of its subcommittees. This corresponds to the policy of the Board of Directors in relying upon the President and the Executive Committee to conduct the administrative and business affairs of U. S. Institute. Upon the Committee on Abstracts and Bibliography and the Committee on Economic Research has fallen the brunt of last year's work of the Research Committee and their reports have been accepted with deep satisfaction by your Directors and Executive Committee.

The preliminary report of the Committee on Economic Research has been received by all members, and, with a selected list of replies, was published in the first issue of our official magazine, TEXTILE RESEARCH. It is also a subject for discussion at this meeting, as a result of which it is hoped that a definite program may be developed.

The Committee on Abstracts and Bibliography, in addition to its usual abstracting work for the monthly official bulletin (which will be materially increased for the enlarged printed issue), acted as the Board of Editors of "Textile Research: A Survey of Progress," and both of these activities will be referred to under those subjects.

The Committee on Testing Methods Research, under authority granted by the Executive Committee, Dec. 4, 1931, undertook with the aid of the Secretary to secure the group financing of a study of Abrasion Machines and Wear Testing. After having developed considerable interest and secured one cooperator at $250, the Committee learned that the proposed study might be covered by one of The Textile Foundation researches. Only the reliability of existing abrasion machines is thus being covered at Alabama Polytechnic Institute. As soon as the exact scope of this study is learned your Secretary will attempt to finance the balance of the proposed research.

The action of the Executive Committee authorizing this type of activity is as follows: "Voted: That the Research Committee and Secretary be authorized to interest members and others in the financing of research on problems selected or approved by the Research Committee, and under terms and conditions to be approved by the Executive Committee, the reports of results of such research, when completed, to be made available to members."

The Magazine TEXTILE RESEARCH

Responsibility for the principal department of the official monthly bulletin, that devoted to abstracts and bibliography, is undertaken by the research sub-committee of that title. It has the benefit of the textile abstracting for Massachusetts Institute of Technology by Prof. E. R. Schwarz, chairman of the committee. Mr. M. W. Weiss, Mr. J. N. Dalton and the Secretary also cooperate in the abstracting. A total of 71 publications throughout the world are the subject of original abstracting, and we also have the benefit with credit to them of the work of several abstract publications. It is the belief of the committee that the monthly bulletin has provided a more complete coverage of world textile research than any other publication, and that with a larger corps of abstractors the service can still be improved and expanded. In Volume I of "T. R. I. Bulletin" 172 abstracts and bibliographies were published, while Volume II, containing two less issues, carried 412.

By vote of the Executive Committee Sept. 28th the publication of a printed, monthly magazine under the title TEXTILE RESEARCH was authorized, this action being made possible by the offer of Mr. William W. Buffum, treasurer of The Chemical Foundation, to have that organization guarantee U. S. Institute against loss due to any expense involved in excess of the cost of the old mimeographed bulletin. The Secretary has the responsibility of editorship with the aid of the Committee on Abstracts and Bibliography as the Board of Editors, and with the Publications Committee of U. S. Institute--Mr. W. W. Buffum, the Treasurer and Secretary—handling details naturally covered by that title.

You have already seen the first issue of 76 pages and 1000 copies and will find it largely self-explanatory of the objectives and hopes of the editors and publishers. This, like U. S. Institute itself, is a cooperative proposition and cannot prove the success it should unless it has the hearty cooperation of every member. Members receive a copy at no extra expense, $2.00 of their dues being applied to the cost of subscription, while the annual subscription rate for non-members is $3.00.

"Textile Research: a Survey of Progress"

Every member of U. S. Institute has received a copy of our first book, "Textile Research: A Survey of Progress," either on approval or on order. For its intrinsic merit, as well as a deserved endorsement of the contributors and editors, whose gratuitous services have made its publication possible, it should be bought, read and preserved by every member. Further, members should cooperate to increase its distribution in order that it may perform its chief service—the promotion of research-mindedness throughout the textile industry of this country.

The first issue of the book is of 2500 copies, and all but 300 copies have been mailed out on order or on approval. The prices quoted to members and to non-members are so low for a book of this size and character that we shall be fortunate to do much better than cover cost if all of the first issue is sold. However, that will be doing better than the average textile mill, and we shall hope for reward in increased membership, if not in pecuniary profit.

Meetings and Policies

Your Directors held three meetings during the fiscal year, all of them in New York City; i.e., Nov. 5, 1931, Jan. 22 and May 4, 1932.

Your Executive Committee held four meetings; i.e., in Boston, Dec. 4, 1931, and Sept. 28, 1932, and in New York City, Jan. 22 and Mar. 17, 1932. The Jan. 22d meeting was a joint meeting of both bodies.

Because of the difficulty of frequently bringing together a quorum of both bodies, the members of which are widely scattered, and also because more effective work on specific activities can be accomplished by small groups, it has been the increasing policy of both bodies to delegate as many activities as possible by the Directors to the Executive Committee and by the latter to sub-committees. Thus far the latter have been made up of Executive Committee members and the President's representative, Mr. Buffum, but it has the authority to call upon any of the directors or other members for such service, or it may increase its membership from six to twelve members, with the President an ex-officio member, should it see fit to take advantage of the action, Feb. 24, 1931, authorizing this revision of Article II, Section 2 of the by-laws.

Special Actions

Among the important special actions voted during the year under review, and committees appointed or elected, were the following:

Authorization of Publication of "Textile Research: A Survey of Progress."—"Voted: (Dec. 4, 1931) To authorize the publication of 'Textile Research: A Survey of Progress' with the Committee on Abstracts and

Bibliography as an editorial board, and with the Publications Department of the Massachusetts Institute of Technology supervising the printing and other publication work; also to authorize the acceptance of the agreement as voted by the Executive Committee of Massachusetts Institute of Technology (No. 886) December 1 with the understanding that cost of the first edition shall not exceed $1000 and that net profits, after Massachusetts Institute of Technology has recovered cost of publication, shall be divided between Massachusetts Institute of Technology and U. S. Institute for Textile Research on the basis of one-third to the former and two-thirds to the latter.''

Financing of Research on Selected Problems.—Voted: (Dec. 4, 1931) Noted under Research Work in this report.

Appropriation and Authorization of Responsibility for Selling ''Textile Research: A Survey of Progress.''—(March 17, 1932) ''Voted: That the Secretary be responsible for the merchandising of the annual 'Textile Research: A Survey of Progress,' and that $300 be appropriated from U. S. Institute funds to defray expenses of the merchandising.''

Publication Committee and Powers.—''Voted: (May 4, 1932) That the following committee be given full power to act on problems connected with the publication and distribution of the book 'Textile Research: A Survey of Progress,' including necessary expenditures, in order to ensure prompt action without calling a meeting of the Executive Committee: The Secretary, Treasurer and Mr. Buffum.''

''Voted: (Sept. 28, 1932) That the report of the Board of Editors of the book 'Textile Research: A Survey of Progress,' noting completion of their work, be accepted with thanks, and that the Secretary be directed to extend the thanks of U. S. Institute to all who had cooperated in making possible the publication of the book.''

''Voted: (Sept. 28, 1932) That the initial edition of the book 'Textile Research: A Survey of Progress' be increased from 2000 to 2500 copies and that the book be copyrighted by U. S. Institute.''

Authorization of Publication of Printed Monthly Magazine.—''Voted: (Sept. 28, 1932) That the publication of a printed monthly magazine succeeding the old mimeographed 'T. R. I. Bulletin,' shall be started with the first number of the first volume under the title TEXTILE RESEARCH, on November 1st, and with publication thereafter on the first of each month. Details of the format, character of contents, printing, price to members and non-members and other details to be referred to the Publications Committee of U. S. Institute (the Secretary, Treasurer and Mr. Wm. W. Buffum) with full power to act.''

Auditor Elected.—''Voted: (Sept. 28, 1932) That Mr. William W. Buffum be elected to act as auditor of U. S. Institute books and accounts for the fiscal year ending Sept. 30, 1932.''

Budget Committee.—''Voted: (Sept. 28, 1932) That a committee consisting of the Treasurer, Secretary and Mr. Buffum, shall prepare and submit to the Directors a financial budget for the next fiscal year.''

Secretary's Annual Report

IN ADDITION to the normal secretarial duties specified by Art. III, Sec. 4 of the By-Laws the Secretary reports here, or in the annual report of the Directors and Executive Committee, upon the following activities: Membership work; publicity; editing of T. R. I. Bulletin and its successor magazine TEXTILE RESEARCH, and as an abstractor for the latter; the editing and preparing for publication of booklets; contributor to the book "Textile Research: A Survey of Progress"; member of Publication Committee; sales manager for the new book; in charge of financing group research work; member of program committee for May 4th and Nov. 3d meetings, etc.

Memberships

No attempt was made to increase the $1000 life memberships during the last fiscal year, of which we are fortunate in having two, those of the Pacific Mills and the American Association of Textile Chemists and Colorists, both of whom qualified during our initial year. It may be noted that the income from each of these memberships about equals the dues of ten annual members. The principal of life memberships is a part of our Permanent Fund and may not be used for current expenses.

Contributing Memberships: On Sept. 30, 1931, we had 35 contributing memberships. The changes during the fiscal year may be tabulated as follows:

Total Sept. 30, 1931		35
Resignations	4	
Transfers to Annual Class	2	6
Renewals		29
Elected 1931–32		7
Contributing Members Sept. 30, 1932		36

Annual Memberships: On Sept. 30, 1931, we had 99 annual memberships, the changes during the fiscal year ended Sept. 30, 1932, being tabulated as follows:

Total Sept. 30, 1931		99
Resignations	11	
Failed to qualify	2	13
Renewals		86
Elected 1931–32		261
Annual Members Sept. 30, 1932		347

During the first quarter of the fiscal year membership work was materially handicapped by the fact that we were without a president, notwithstanding which there was no relaxation of effort and during that period eight new annual members were elected. Renewals of contributing memberships, not including those originally definitely taken out for only one year, were reported at the Jan. 22nd meeting of the Directors as nearly 100 per cent and of annual members 90 per cent.

At the Jan. 22nd meeting, it was decided to postpone indefinitely, on account of unpropitious business conditions, the proposed campaign of the membership promotion committee, appointed the previous Fall. That was the meeting at which the acceptance of the presidency by Mr. Garvan was announced to the Directors, and his election provided the factor that ended the membership depression. Without going into details of the work since then, other than to record our indebtedness to President P. J. Wood of the American Association of Textile Chemists and Colorists, who is one of our directors, for his willingness to allow his name to be used in a canvass of the membership of that organization that resulted in securing several contributing and annual members for U. S. Institute, it may be stated that during the period since Jan. 22nd, we have added six contributing and 255 annual members, closing the fiscal year with a total of 385 memberships. This membership is unique in that it is drawn from all branches of the textile industry, and is the industry's most representative body of such diversified character. A notable feature of our membership, and one for which we should give thanks, is that we have not lost a member by death. This may be accepted as circumstantial evidence that research-minded men are long lived.

Publicity

Our publicity work includes booklets and reprints of addresses and articles that we have circulated ourselves, as well as news releases of meetings and other activities that have been generously used by the Trade Press and the daily papers. There are 30 publications in our news-release list, and although we are without a clipping service our scrap book of such printed matter is of impressive size. Your Secretary is deeply appreciative of this cooperation, and desires also to congratulate the Trade Press upon the increased amount of space that most of them are now giving to technical and general articles of a research character.

The addresses and reports of our last annual meeting, and those emanating from the luncheon-reception to President Garvan in May, naturally received the most publicity, but our "Survey of Textile Research in the United States, 1931," compiled for The Textile Foundation, the preliminary report of the Committee on Economic Research and our new book have been the subject of generous comment. Among the booklets and reprints circulated among members and in membership work were the following: photostat reproduction of the editorial in Textile World, Nov. 21, 1931, entitled "When Growth Stops, Decay Sets In"; booklet containing biographical sketch of President Garvan and reprint of the Secretary's article in the annual textile issue of the *Journal of Commerce*, 1000 copies of which have been used; an issue of 250 mimeographed copies of the Preliminary Report of the Committee on Economic Research. Your Secretary also compiled the usual booklet of names of members, officers, directors and committees, also a revised copy of the by-laws.

Survey of Textile Research

Although the "Survey of Textile Research in the United States, 1931," was compiled for and accepted by The Textile Foundation during the fiscal year 1930–31, it was later published in a somewhat condensed edition for general circulation, the latter edition containing a very complete index and cross-index prepared at the Bureau of Standards under the direction of

Dr. W. E. Emley, chairman of our Research Committee. A copy of this edition was forwarded to all of our members last December, and we have distributed direct or through the Foundation office a large number of copies since then; in fact, hardly a week goes by that we do not receive a request for this survey.

Lest new members confuse this report with the book under a somewhat similar title just published by U. S. Institute it may be stated that the Foundation survey merely lists mill, commercial, educational and governmental laboratories engaged in textile research and the titles of their researches, with the character of the latter merely indicated. The book, "Textile Research: A Survey of Progress," is the story of recent textile research and its trends, each subject being treated by an authority.

The Official Magazine

All of the editing and preparing of the monthly "T. R. I. Bulletin" for mimeographing, excepting the abstracting, was the work of the Secretary's office, and the Secretary is also one of the abstractors. Volume II of the Bulletin, starting with the January number, and including eight issues, contained a total of 136 pages, of which 103 were devoted to abstracts, bibliography and book reviews, the total number of these being 412; the other 33 pages carried reports of meetings and committees, research news and a few research reports. This was a marked improvement in service as compared with that rendered by Volume I, in the ten numbers of which volume only 172 abstracts were published.

The total cost of the eight numbers of Volume II, not including work of the Secretary's office or any expense for contributed text, but including mimeographing and mailing, was $256.22, or an average of $32.03 per number, of which an average of 250 copies were mimeographed and 185 mailed.

From the start of this service it has been recognized that mimeographed production was inadequate and would not allow publication of research reports requiring illustration; also that numbers of more than 15 pages raised the mailing expense to a basis that would cut seriously into available funds, most of the large issues costing 3 to 4½c for postage.

The large increase in membership at the Sept. 28th meeting of the Executive Committee brought the subject of an enlarged printed bulletin to a head, and the result, as noted in the annual report of your Directors, was authorization of monthly publication of the printed magazine "Textile Research." The first number of the magazine should have been received by all members Nov. 1st, and the Foreword therein conveys a general idea of its future format and character. The preparation of this first number necessarily was a rush job, and without the generous cooperation of Mr. Buffum of the Publications Committee and Prof. Schwarz of the Board of Editors, it would have been impossible for your Secretary to produce the issue in so short a time. By printing 1000 copies of the November number we shall have a surplus for use in membership work, for which it has been intentionally adapted by insertion of a list of officers, directors, committees and memberships as of Sept. 30. The usual printing will be of about 500 copies. We now have in this magazine a suitable medium for the publication of all worthwhile textile research work, and we hope to merit the cooperation of all engaged therein in the utilization of this magazine for giving publicity to and securing permanent record of their work. With

such cooperation there is no reason why it should not provide a service equal to that of similar foreign publications.

Our New Book

Reporting as sales manager of our new book "Textile Research: A Survey of Progress," your Secretary desires to record the fact that initial sales work has been simplified by action of the Publications Committee authorizing mailing of the book for free examination to members and to a selected list of textile firms, this action being made possible by the guaranteeing of U. S. Institute against loss on the distribution of 2000 copies, volunteered by Mr. Buffum as treasurer of The Chemical Foundation. Your Secretary prepared the list of textile firms to receive copies on approval and also copy of the letter of transmission and other publicity, but the work of transcribing and mailing the letters was the gift of The Chemical Foundation.

To Nov. 1 a total of 2262 copies have been shipped either on order or approval. Of these 337 went on approval to members who had not ordered in advance, 1787 to the selected list of non-members, 27 to contributors, 27 to publications for review, and 84 on advance orders. Since Oct. 27th when the first approval copies were shipped, additional orders for 14 copies have been received and 25 have been taken for commission sale. Some returns of copies shipped on approval are to be expected and to Nov. 1 aggregated 80 copies on which U. S. Institute guaranteed return postage and express charges. The latter may prove a considerable item of expense as postage per copy averages 14–16 cents and expressage 16 cents.

Your Secretary has prepared follow-up letters and other matter to be used in efforts to make approval copies stick, and also for the development of additional sales.

Directors Whose Terms Expire

The term of the following directors, elected for two years, expires at this meeting:

JAMES T. BROADBENT
HON. FRANCIS P. GARVAN
ERNEST N. HOOD
WESTON HOWLAND
P. H. HANES
W. SCOTT LIBBEY
ALBAN EAVENSON
PROF. L. A. OLNEY

The following vacancies in the Board of Directors are to be filled: Albert F. Bemis (resigned) for term expiring in 1933. Walter C. Taylor (resigned) for term expiring in 1934.

Respectfully submitted,
C. H. CLARK, *Secretary.*

Research Committee's Report

YOUR COMMITTEE has held three meetings since the annual meeting of the Institute last year, and has made substantial progress towards its main objective. This objective may be defined as the stimulation of textile research by providing organized machinery for correlating the vast amount of work already under way.

Early in 1931 the committee decided that a survey of the existing facilities, accomplishments and man-power was the prerequisite for suc-

cessful planning. With the assistance of the Textile Foundation, this survey has been completed and published.

Sub-Committee Work

It then became evident that the field of textile research was too broad to be cultivated as a whole. Six sub-committees were therefore organized, each to deal with a part of the subject. Establishment of these sub-committees was fraught with the usual vicissitudes. Three of the original six chairmen found it necessary to withdraw, and there was some difficulty in finding successors who were not only willing but also competent to serve. This task has now been completed, and some of the sub-committees have taken hold of their work so quickly that they are now ready to stand on their own feet.

To stimulate the sub-committees, various specific problems were assigned to them, with the request that they try to get appropriate action taken by interested research workers. It has been decided to continue this plan during the coming year. Each sub-committee will be held accountable for due progress in the work assigned to it.

Published Literature

The sub-committee on textile literature, or rather Professor Schwarz, almost single-handed, has arranged for the compilation and publication of the book on "Textile Research: A Survey of Progress" which is just off the press. This is a volume of which the textile industry may well be proud. It proves that in so far as research is concerned this industry is not so backward as reported. I urge you particularly to read the chapters dealing with subjects with which you are not intimately acquainted. You will be amazed, as I was, at the enormous amount of work going on, and at the way in which all work in the textile field is interrelated.

Professor Schwarz has also carried the full load of abstracting the textile literature for publication in our monthly bulletin. He has recommended to the Executive Committee that he be given assistance in this work. Surely you will agree that this is as important as anything the Institute can do for the benefit of the textile industry.

Contact with Industry

Mr. Clark, as chairman of the sub-committee on contact with industry, also has two jobs: The survey of research facilities, mentioned above, must obviously be kept up to date, and Mr. Clark has the responsibility of keeping a current file on the subject. Acting on instructions from the Executive Committee, he is now engaged in the collection of a fund to finance a specific research problem.

Academic Research

Dr. Schiefer reported that certain problems assigned to his committee are being studied at cooperating laboratories of U. S. Institute: the problem of developing micro-chemical technique for the study of fibres being under way at M. I. T., and a study of the effect of light on weighted silk is under way at the Bureau of Standards, in cooperation with the American Association of Textile Chemists and Colorists.

Mill Research

Prof. Willis reports that he has not yet had an opportunity to get his sub-committee on mill research properly organized nor to look into the problems which had been assigned to that sub-committee. Prof. Willis was requested to proceed as promptly as possible with the selection of an appropriate personnel for his sub-committee. He was informed that it is the belief of the committee that work on the spinning values of different grades of cotton is now being conducted by the Bureau of Agricultural Economics, and that work on the elimination of possible steps in the spinning of worsted yarns is being conducted at Lowell Textile Institute.

Economic Research

The sub-committee on economic research, under the able leadership of Mr. Scheel, has made so much progress in its work and plans that it has been given a major position on your program this afternoon. I shall therefore say nothing further about it at this time.

Testing Methods Research

Prof. Ball reported that work on abrasion testing was well under way at Alabama Polytechnic Institute under a research fellowship from the Textile Foundation. Other phases of this problem need consideration, but this work is contingent upon receipt of funds from the industry in response to the solicitations to be made by Mr. Clark.

Frequent Progress Reports

Since each of the six sub-committees has now one or more definite problems assigned to it, the research committee decided to call for progress reports on these specific problems at comparatively frequent intervals, with the idea that no new work will be undertaken until some definite results have been produced.

You will see from the above that the Research Committee has made real progress on the work assigned to it. It is believed that we are definitely building towards the attainment of the ideals established by the founders of this Institute.

"Practically any manufacturing business in which the management is shrewd enough to make money without a laboratory, will make more money with an adequate staff of scientific men and the physical equipment to back them up."—J. M. Troxel.

Abstracts

1. Fibres (Synthetic and Natural) and Fibre Analysis

Animal Hair: Some Notes on. F. O'Slaherty and W. Rodey. *Jnl. Am Lea. Chem. Assn.*, April, 1932, P. 126.

The article describes the microscopical characters of various types of hair, giving data as to the average size and form and root shaft ratio. (Copied complete from *Bausch & Lomb Abs. Bull.*, No. 8, 1932.) (S)

Cellulose: Micellar Changes in the Viscose Process. S. M. Lipatov and N. A. Krotova. *Chem. Abs.*, Vol. 26, 1932, P. 3373 (from *J. Appl. Chem. U. S. S. R.*, 1931, 4, P. 1030).

Cellulose has a micelle structure. Changes which occur on swelling reactions with carbon disulphide and solution of the xanthates formed in sodium hydroxide are explained by the destruction of micelles. This destruction is preceded by gradual weakening of the attraction between individual chains. This attraction is completely destroyed only after the xanthate is dissolved in sodium hydroxide. Mercerisation, formation of xanthates and solution are associated with the reactions: $[(C_6H_{10}O_5)_n]_m \rightarrow m(C_6H_{10}O_5)_n$, while solution in sulphuric acid is associated with the reactions: $(C_6H_{10}O_5)_n \rightarrow \ldots \rightarrow nC_6H_{10}O_5$. (Copied complete from *J. T. I. Abstract Section*, Oct., 1932.) (S)

Cellulose Xanthate: Formation and Solution. I. Sakurada and R. Inoue. *J. Soc. Chem. Inc.*, Japan (Suppl.), Vol. 35, 1932, P. 127B–130B.

Investigations of the influence of the duration of the sulphide treatment and of the concentration of the mercerizing alkali on the formation and the solution of cellulose xanthate are described. Different celluloses with different alkali contents were xanthated for three hours, then immersed in water for three hours and the soluble and insoluble constituents finally separated. Both components showed the same degree of xanthation. The curve showing the solubility as a function of the period of xanthation has an S-shaped form; i.e., the solubility increases with the time slowly at first, then rapidly and later more slowly. Since, in contrast to this result, the xanthation increases rapidly at first and then becomes continuously slower, the formation of the xanthate and the solution of the xanthated product do not run parallel. This result can be explained by a consideration of the membrane systems in the natural fibres and the effects of purification processes on these systems. The degree of xanthation increases with the concentration of the mercerizing alkali, and the alkali adsorption curve coincides with Vieweg's curve for the alkali adsorption of ramie fibres up to a concentration of about 6N sodium hydroxide. Hence it is concluded that alkali cellulose is the basis for xanthate formation. The variations from Vieweg's curve at alkali concentrations greater than 6N, where the alkali

adsorption of the xanthate decreases and where X-ray investigations indicate the presence of soda cellulose II, show that the latter must be more difficult to xanthate than soda cellulose I. (S)

COTTON FIBRES: A METHOD FOR DISTINGUISHING BETWEEN OLD AND NEW. A. W. Winne and J. Davis Donovan. *Am. Dye. Rptr.*, Oct. 10, 1932, P. 601.

Many of the American states have passed laws requiring the kind and nature of materials used in filling bedding and upholstered furniture to be disclosed to the purchaser, usually by means of a statement on a cloth tag attached to each article. Most of these laws require that material which has had previous use be labelled second-hand, and one of the most difficult problems for those charged with the enforcement of the laws has been the detection of second-hand cotton filling that has been described as new material. No visible change appears in cotton fibres as a result of previous use and laboratory tests have been unsatisfactory and inconclusive. (S)

COTTON FIBRE: VARIATION IN THE PROPERTIES OF, IN RELATION TO ITS POSITION ON THE SURFACE OF THE SEED. Ram Saran Koshal and Nazir Ahmad. *J. T. I.*, Oct., 1932, P. T211.

This first part of a series is concerned with fibre length, weight and strength. After a brief statement of some nine conclusions the authors state: "There is a distinct tendency for a high ginning percentage to be associated with low percentage difference between mean fibre-length of hairs taken from the apex and base of a seed."

The practical applications of this investigation are discussed in Section VII. It is pointed out that in selecting new strains the cotton breeder should pay attention, not only to the absolute values of the fibre-properties, but also to the percentage difference between the mean values of the properties of hairs growing on the base and the apex of the seed. An analysis on these lines will at once differentiate between two strains with respect to the regularity of their staple, thus enabling the breeder to select the particular strain which will yield a more uniform lint. Secondly, on account of the large differences in the base and apex mean values of some cottons, it is suggested that if a method of differential ginning could be devised which would remove the lint from the two flanks and the base of the seed separately from that on its apex it would be possible to obtain from the same seed two lots of cotton, one lot being appreciably longer and finer than the other. Such a differential gin would act as a combined ginning and combing machine. The suggestion is made for the benefit of those who have a mechanical bend of mind. Thirdly, it is pointed out that in view of the unexpectedly large differences in the base and apex mean values of the various fibre-properties it is extremely necessary, wherever possible, to take a fairly large sample for the determination of any of the fibre-properties. Where, owing to the tedious and time-absorbing nature of the work, a fairly large sample is ruled out, the sample selected should be so constituted as to be thoroughly representative of the bulk, otherwise a preponderance of basal or apical hairs in the sample will introduce a large error in the result. A large amount of graphical and tabular data is included. (S)

OXIDATION BY GASEOUS OXYGEN OF COTTON IMPREGNATED WITH SODIUM HYDROXIDE SOLUTION. Geo. F. Davidson. *J. T. I.*, June, 1932, P. T95–T134; cf. *Chem. Abs.*, Vol. 26, 1932, P. 5424.

The oxidation by gaseous oxygen of cotton impregnated with NaOH solutions of concentrations from 2.5 N to 15.2 N at temps. of 20–60° was studied relative to the oxidation process and the properties of the oxycellulose produced, and also as a possible laboratory method for the preparation of chemically modified cottons. In every experiment, the rate of absorption increased for a time and then became practically constant, which may be explained by the hypothesis that the oxidation consists of several consecutive reactions. The rate of oxidation at both 40° and 60° increased rapidly when the concentration of NaOH was increased from 2.5 N to 5 N, and then less rapidly up to 10N, where a well-defined maximum rate was observed. The rate decreased with further increase of concentration. Iron, copper and nickel had considerable catalytic effect, while manganese greatly retarded the oxidation. Oxidation leads to an increase in fluidity in cuprammonium solution and of copper number, the increase of both properties being rapid at first and slowing up as the oxygen absorption increases. (W)

SILK: THE ISOELECTRIC POINT OF. Milton Harris. *Am. Dye. Rptr.*, Oct. 10, 1932, P. 603.

Suspensions of silk in buffer solutions of different pH were prepared by grinding the dry silk fibroin to a fine powder and shaking it in the buffer solution. Colloidal solutions of silk were prepared by dissolving the silk fibroin in a 50 per cent solution of lithium bromide and dialyzing it to remove the salt. To the solutions were added known buffer mixtures and a small amount of purified quartz powder. Electrophoretic measurements of the suspensions of silk and of the dissolved silk adsorbed on the quartz particles gave an isoelectric point at pH 2.5. (S)

SWELLING OF WOOL FIBRES IN WATER AND IN AQUEOUS SOLUTIONS OF SODIUM HYDROXIDE AS SHOWN BY CHANGE IN CROSS-SECTIONAL AREA. M. H. Norris. *Trans. Faraday Society*, Vol. 28, 1932, P. 618–26; cf. *Chem. Abs.*, Vol. 26, 1932, P. 5425.

An apparatus was made so that the fibre could be centrally located in the solution, prevented from twisting, and its diameter measured microscopically at definite points. Fibres of greasy Lincoln wethers wool were measured successively in (1) glycerol, (2) H_2O, (3) 0.05 N NaOH, (4) H_2O, (5) glycerol, (6) H_2O, (7) 0.05 N NaOH, (8) H_2O, (9) glycerol, the value in glycerol being taken as standard. The values for percentage swelling for the same fibre in (1), (5) and (9) were identical; those in (3) and (7) were also identical, but, while those in (4), (6) and (8) were the same, they were larger than the value obtained during the first water treatment. Results varied from fibre to fibre, but a group selected as undamaged gave no more consistent results. This, it is suggested, is due to some innate chemical difference between fibres. The behavior is explained by the postulation that water enters only between the micelles, while NaOH penetrates them; thus after a fibre has once been treated with NaOH, H_2O can also enter the micelles, while glycerol dehydrates the fibre whether damaged or not. (W)

VISCOSE RAYONS: APPARENT STRETCH OF, AND ITS IMPORTANCE IN TEXTURE AND USE. H. Weinges. *Forsch. dent. Forschungsinst. Textilind.*, Dresden, No. 12, 1931, P. 5–61; *Chem. Zent'blatt*, Vol. II, 1931, P. 1952–3; *Chem. Abs.*, Vol. 26, 1932, P. 5416.

Viscose rayons, I normal, II spun under tension, were compared and load-elasticity diagrams obtained. The resistance to breakage of II is appreciably greater than that of I. Wet, the rayon is almost completely elastic and the elastic limit is always exceeded. Recovery after wet stretching is always better with II than with I. The elastic limit is reached at 35% of the breaking strength for each. For textile purposes, I is concluded to be better for filling yarns. (W)

II. YARNS AND FABRICS

CARBONIZING PROCESS: PHYSICAL CHEMISTRY OF THE. Alan A. Claflin. *Am. Dye. Rptr.*, Sept. 26, 1932, P. 575.

The summary of this paper shows that researches in leather chemistry show protein fibres combine as a base with acid radicles, that the content of water and concentration of acid in the fibre change with the concentration of the acid in the external water, and that with these changes the physical condition of the fibre changes. (S)

COTTON: THE MOISTURE RELATIONS OF. VIII. THE EFFECT OF PROCESSING. Alex. R. Urquhart, Wm. Bostock & Norman Eckersall. *J. T. I.*, July, 1932, P. T135–T149.

A piece of cloth was passed through the normal routine of a bleach works; after the kier-boil it was divided into two parts, one portion being bleached and the other mercerized and bleached. The resulting materials were dyed with four typical dyes. Samples of the materials were examined at each stage of the processing by methods previously described. The hygroscopicity decreased slightly but steadily with increase in duration and in temperature of drying. The great adsorptive capacity possessed immediately after the mercerization process was impaired continuously as the material was dried down the primary desorption curve. The hygroscopicity of cotton was reduced somewhat by chemical attack. The reduction was small except where the attack was so serious as to cause almost complete loss of strength. (Copied complete from *Chem. Abs.*, Vol. 26, 1932, P. 5424. (W)

RAYON YARNS AND FABRICS THROUGH THE MICROSCOPE. (Concluded.) E. R. Schwarz. *Mell. Tex. Mo.*, Oct., 1932, P. 442.

The second part of an article discussing the application of micro technique to the analysis of rayon fabrics. Illustrated by photomicrographs. (S)

TAKER-IN SPEEDS ON CARD WASTES, SLIVER, AND YARN: THE EFFECTS OF DIFFERENT. Horace Spibey. *J. T. I.*, Sept., 1932, P. T183.

The results of the investigations may be summarized as follows: At the slowest taker-in speeds (up to 309 r.p.m.) the flat strips are more flocky and dirty, containing more short fibre; the web is more irregular and cloudy, showing that such taker-in speeds are unsatisfactory. Raising the taker-in speed has the following consequences: The taker-in waste increases

almost proportionately and contains a higher proportion of good cotton, whereas the cylinder and flat strips decrease, but in a less degree, so that the total card loss increases slightly on balance; the sliver contains rather more short fibre, but its regularity (in weight per yard) is unaffected; the yarn, however, is stronger and not appreciably different in appearance. There is an upper limit to the taker-in speed, at which fibre accumulates on the teeth; this upper limit lies between 649 r.p.m. and 845 r.p.m., when the surface speed of the cylinder is respectively 1.28 and 1.05 times that of the taker-in. The cost of carding increases with the speed of the taker-in, largely owing to the loss of good cotton in the taker-in fly, but this disadvantage might be overcome by suitable modifications of the encasement. (S)

III. Chemical and Other Processing (Not Otherwise Classified)

Adsorption of Dyes on Diamond, Charcoal and Rayon. H. Lachs and S. Parnas. *Z. Phys. Chem.*, A160, 425–44, 1932.

In the adsorption by diamond and acetate rayon, the measured surface area of the adsorbent shows the adsorbed film to be unimolecular, and, though the other adsorbents have greater adsorptive power, this is due to the existence of a large internal and adsorbing surface in addition to the observed surface, and there is no evidence of the formation of multimolecular fibres. The internal surface of viscose exceeds that of cuprammonium rayon. (Copied complete from *Chem. Abs.*, Vol. 26, 1932, P. 5241.) (W)

Determination of Sulfur Black Dyestuff on the Fibre. R. S. Osipov. *Izvestiya Tekstil. Prom. Torgov.*, Vol. 10, No. 12, 1931, P. 68–71; *Chem. Abs.*, Vol. 26, 1932, P. 5423.

The author determined the amount of the dye by means of its nitrogen content by the Kjeldahl method. According to Schultz's tables, there are two formulas for sulfur black, viz., $C_{24}H_{16}N_6S_8O_8$, and $C_{28}H_{16}N_6S_6O_8$, with sulfur contents of 33.18% and 27.1% respectively. The dye used by the author was nearer the former value, and he therefore adopted the first formula, corresponding to 10.88% nitrogen. The amount of dye on the fibre is therefore given by 100A/0.1088, in which A is the N content of 1 g. of dyed fabric. (W)

Kiering Processes: Study of, Using a Potentiometer. P. P. Viktorov and B. Goldberg. *Mell. Textilber.*, Vol. 12, 1931, P. 638–41; cf. *Chem. Abs.*, Vol. 26, 1932, P. 5424.

Theoretically, in the kiering of raw cotton, the amounts of NaOH consumed in saponifying natural fats and waxes, in combining with the decomposition products of the pectin impurities, and in decomposing proteins, are in the ratio 41 : 700 : 850, and in these reactions only 50% of the usual amount of NaOH present is utilized. Large scale trials with a partly purified cotton showed that only 20% of the NaOH initially present was utilized in removing the impurities, while 60% was adsorbed as in mercerizing processes; the remainder appeared to be ineffective. (W)

IV. Research Methods and Apparatus

Color Testing: Practical Aids to. T. T. Baker. *Kinemat. Weekly*, Dec. 17, 1931, P. 35, 39.

The author advises the use of a test chart to check the reproduction in the case of either monochromatic or color photography. The design of chart is discussed and a simple arrangement of blue, green, red, yellow, pink, blue-green, black, white, and three intensities of gray patches is advocated. The chart is made up so that it can be photographed in a "still" camera on a 5-inch strip of motion picture stock. For black and white work, instead of arranging the colors in a studio set in accordance with the color-sensitivity of the film stock, the author advises the use of panchromatic film in conjunction with a correcting filter, so that the various colors of the set will be recorded with correct visual luminosities. Particular colors can be accentuated or depressed by the use of supplementary contrast filters. (Copied complete from *Eastman Kodak Bulletin*, June, 1932.) (S)

Impregnated Fabric Bearings: Application of, to Roll Necks. Arthur J. Schmitt. *Trans. A. S. M. E.*, Apr. 30, 1932.

The suitability of celoron for roll-neck bearings has led to widespread use of the product in that field. Its resilience allows bearings to absorb severe impact loads without permanent deformation. Celoron bearings are most commonly lubricated with water, in which case the rate of wear and the power consumed in friction are much less than those of metal bearings. The application of a superior lubricant such as oil or grease improves their performance appreciably. Celoron bearings serve most efficiently on highly polished roll necks, and they have produced substantial power savings in comparison with metal bearings, and their life in numerous installations has been found to be many times that of metal bearings. (S)

Microscope in the Service of Textiles. H. Ellis. *Watson's Microscope Record*, Jan., 1932.

Part II of the above article. Other articles of interest are on "Permanent Fluid Mounts" and one about a new mounting for diatoms. The publication may be obtained post free by writing to 313, High Holborn, London, W. D. (Copied complete from *Bausch & Lomb Abs. Bull.*, No. 8, 1932.) (S)

Microscopic Examination. E. S. Dowding and A. H. R. Buller. *Can. J. Rsch.*, Jan., 1932, P. 1.

Infected hairs differ in their fluorescence characteristics from normal health hair. Methods are given for the identification of infected material, isolation of the fungi. Illustrated by photomicrographs. The paper also contains description of various fungi, methods of cultivation and identification. (Copied complete from *Bausch & Lomb Abs. Bull.*, No. 8, 1932.) (S)

Physical Structure of Coal, Cellulose Fibre, and Wood as Shown by the Spierer Lens. Reinhardt Thiessen. *J. Ind. & Eng. Chem.*, Sept., 1932, P. 1032.

The physical structure of cellulose fibre, wood and coal as seen by the Spierer lens (see *J. Phys. Chem.*, 35, 118) are described and illustrated by

photomicrographs. The micelle structure of plant tissues is clearly shown and no longer leaves any doubt that wood fibres or cellulose fibres, as in cotton and ramie, are definitely built up of micelles in characteristic arrangement, and verify the Nägeli micelle theory and the structure postulated by X-ray methods. (S)

SPECTROPHOTOMETERS: NEW POLARIZING SYSTEM FOR. J. H. Dowell. *J. Sci. Instr.*, Dec., 1931, P. 382.

An improved form of Nicol prism is described in which the scattered light transmitted has been reduced to a minimum by the extension of the upper part of the prism and the provision of a polished face normal to the direction of the ordinary ray. The reflected light thus passes out of the prism where it can be conveniently absorbed. An improved polarizing system for spectrophotometers utilizes three Nicols in series, the first and last being arranged to transmit light polarized in the same plane, while the middle one is made to rotate. The advantage of such a system, in which the intensity follows the law $I_1/I_2 = \tan 4\theta$, is that it enables more accurate measurements to be made of high absorptions. (Copied complete from *Eastman Kodak Bulletin*, June, 1932.) (S)

TENSILE STRENGTH: A LIMITING FACTOR IN WEAR. H. P. Gurney and E. H. Davis. *J. T. I.*, Sept., 1932, P. T201.

An analysis of data obtained on a modified Amsler abrasion machine, expressed as cycles to rupture. Notes the fact that almost all kinds of wear tests involve the application of repeated or alternating stresses, even though apparently abrasion at first appears to be the predominating type of wear. (S)

TRICHROMATIC COLORIMETER. J. Zernike. *J. Op. Soc. Am.*, July, 1932, P. 418.

An ingenious device employing three light sources. Two are mercury lamps for the green and violet, while the remaining red is furnished by a neon lamp. An interesting combination of half mirrors and filters is employed to combine the colors for the purpose of matching a sample. Positioning the lamp by means of rack and pinion focussing mounts together with adjustment of certain diaphragms give the desired readings. The instrument is not independent of the human eye. (S)

TRICHROMATIC FUNCTIONS OF THE AVERAGE EYE. W. F. Hamilton and Ellis Freeman. *J. Op. Soc. Am.*, June, 1932, P. 369.

Readers of TEXTILE RESEARCH will be interested in this paper because of the fact that the chromatic functions of the eye of a so-called "standard observer" afford opportunity for interpretation of certain data and its correlation with practical dyeing. Such data will be obtained from the spectrophotometric color analyzer now nearly completed under a Textile Foundation fellowship at M. I. T. (S)

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Asbestosis. (Editorial.) *Am. J. Roent.*, Aug., 1932, P. 250.
Pathological effects of inhaling asbestos particles. (S)

Cellulose Acetate: Manufacture of. V. E. Yarsley. *Brit. Plastics*, Jan., 1932, P. 344.

A review of the recent patent literature is given. (Copied complete from *Eastman Kodak Bulletin*, June, 1932.) (S)

Cotton: Genetics of. Thos. K. Kearney. *J. Hered.*, Vol. 21, Nos. 7, 8, and 9, 1930, P. 325–36, 375–84, 409–15.

A series of three articles surveying the present state of knowledge. (S)

Iron Stains on Wool. P. W. Hargreaves. *Dyer*, Vol. 68, 1932, P. 129–30.

A discussion of their detection and removal. (Copied complete from *Chem. Abs.*, Vol. 26, 1932, P. 5423.) (W)

Jute Fibre: Some Acid Constituents of. J. K. Chowdbury and M. N. Mitra. *J. Ind. Chem.*, Vol. 9, 1932, P. 291–6.

The determination of glucuronic, galacturonic, and pectic acids is given. (Copied complete from *Chem. Abs.*, Vol. 26, 1932, P. 5425.) (W)

Serimitry: Research in. Rieder. *Die Kunstseide*, Vol. XIV, No. 9, 1932, P. 292.

A short article giving formulae and tabular matter for the evaluation of the usual physical test data for silk. (S)

Wild Silks: I. Isoelectric Point of Wild-Silk Fibroin. S. Bito. *Bull. Sericult.*, Japan, Vol. 4, No. 2, 1931, P. 2–3.

Dilaysed dispersions of degummed tussah and kuritwata silk in aqueous calcium thiocyanate solutions have the isoelectric points pH 2.79 and pH 2.85, respectively. (Copied complete from *J. T. I.*, Oct., 1932.) (S)

II. Yarns and Fabrics

Mixed Yarns Composed of Cotton and Rayon: The Spinning of. A. Jaumann. *Die Kunstseide*, Oct., 1932, P. 327.

The spun thickness of fine staple yarns depends upon the fineness of the single fibre and its spinning capacity. Use of cotton makes spinning easier but reduces the lustre of the yarn. (S)

Mothproofing of Wool in Wool and Rayon Mixture Fabrics. G. Rudolph. *Die Kunstseide*, Vol. XIV, No. 9, 1932, P. 304.
Outlining treatment with Eulane. (S)

Oil Damage to Cotton Tenting Materials. O. M. Morgan. *Can. J. Rsch.*, Vol. 6, 1932, P. 306–8.

The effect of weathering on white and brown cotton duck tenting materials treated with a variety of oils was investigated. Mineral oils produce moderate damage, while cottonseed oil gave losses of 73% tensile strength during a 240-day exposure. Mineral khaki has a weather-proofing and oil-resisting action on cotton. (Copied complete from *Chem. Abs.*, Vol. 26, 1932, P. 5425.) (W)

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The original article, reprinted in several magazines. (S)

Yarn Properties: Graphical Determination of. W. Schroeder. *Die Kunstseide*, Vol. XIV, No. 9, 1932, P. 306.

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A short article in popular vein illustrated with twelve photomicrographs and designed to show something of the scope of fundamental textile research from the optical standpoint. (S)

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An interesting description by the American Consul at Canton outlining progress made in silk research carried on at that city. (S)